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Progress in Design of Mining Machines Has Greatly Reduced Labor Cost of Cutting Kerf in Coal

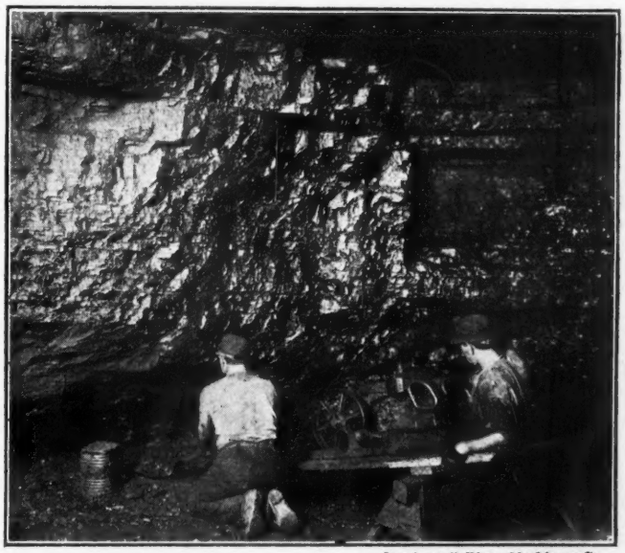
Review of Different Types of Machines—How Union Restrictions Hamper Progress—Records of Work Accomplished by Old and New Types and Information as to Current Used in Cutting

MINING machines are now cutting as many as sixty places in a shift and averaging thirty to thirty-five places. With coal 8 ft. thick and a place 15 ft. wide the tonnage obtained would be between 1,200 and 2,300 tons per day. The new machines eliminate much of the labor formerly necessary. Some do not have to be unloaded, merely personally conducted from job to job, and at that they carry their conductor with them. So easy is it to handle some of these machines that the work of cutting tends to become as light, if not as pleasant, as tending a steam engine or an electric generator on the surface.

As no stationary engineer would wish to make his piston make one stroke less than that for which it is designed, so no man running one of these labor-saving machines would care to diminish by a ton the quantity it would cut. For this reason a day-wage scale is well suited to cutting with machinery of this type, and if a tonnage scale must be made it should be much lower than that fixed for the early breast machines, which involved much labor and made comparatively little headway.

The relative outputs of modern and less modern machines are indicated by the new scale formulated by the Monongahela Coal Association, the operators comprising which own sixty-five mines on the Monongahela Ry. and the Morgantown & Wheeling R.R. This scale, posted Feb. 23, gives the following room-and-pillar mining rates: Breast machine, 9c. per ton; shortwall machine, 8c., and arcwall machine, 4.5c. When it is understood that the tonnage rate set is expected to reward the operative who handles the machine as well as the operator who provides it, it will be realized that a bigger advantage even than that reflected in the figures is obtained from the use of more up-to-date equipment.

Especially is this true because rapid cutting makes it possible to get a large tonnage from a small area, reducing haulage, ventilation, pumping and supervision costs. With some machines it makes it possible to operate by methods under which the roof could not be controlled were a slower method of mining adopted. The coal is pulled from under the roof so speedily that it is out before the measures have adjusted themselves so that they can fall. We are beginning to learn that under some conditions roof demolition is a progressive series of failures instead of a single collapse, and with speedy extraction the fall may not occur till the worker has worked his way well out of danger. Slowness in operation always results in loss of coal.



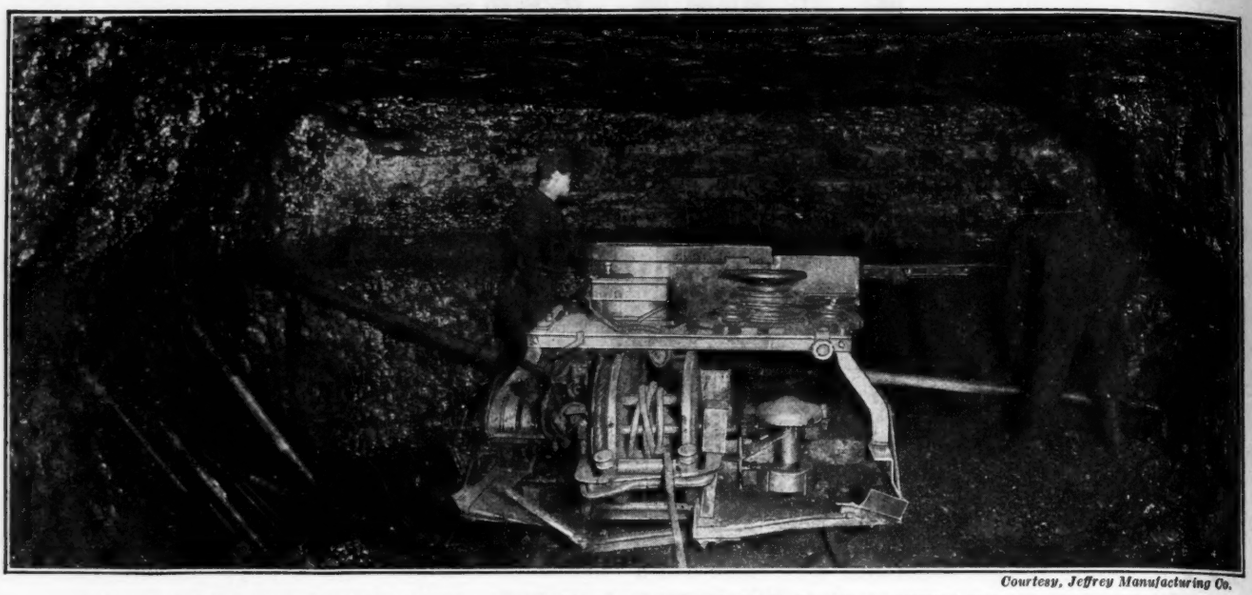
Courtesy, Sullivan Machinery Co.

FIG. 1. PUNCHER IN THICK COAL, ILLINOIS MINE

More correctly termed a pick machine, but usually known in coal-mine vernacular by the name given. This machine cuts an ideal kerf, which causes the coal to fall forward when shot down much as a tree falls when cut by an axe. The coal so cut breaks into large lumps but does not form a solid wall, and so is readily loaded. The slack is coarse and more readily vendible than "bug dust." But the puncher has lost much of its popularity. It involves too much work and skill and is slow in action. This is an old illustration, showing what was regarded at the beginning of the century as the last and best word in undercutting.

Just as the first attempts at the steam propulsion of ships simulated the oar and its movement, just as the first mowing machines imitated the hand scythe and its operation, so early efforts to produce a mining machine borrowed the action of the hand pick. Whereas the "steam rowboat" and the horse-operated scythe were failures, however, the pneumatic puncher after a term of development attained a marked degree of success.

Across the Atlantic our British friends developed the disk and bar undercutters. The first somewhat resembles a huge circular saw that may be drawn along the face, cutting a narrow gash beneath the coal in



Courtesy, Jeffrey Manufacturing Co.

FIG. 2. ARCWALL MINING MACHINE CUTTING BAND IN MIDDLE OF SEAM WITHOUT LEAVING TRACK
This machine has a long arm that makes a series of crescent-shaped cuts in the semicircular coal face. The rooms are absolutely all of the same width, dependent on the radius of the swinging cutter bar. As many as thirty-five rooms have been cut in an eight-hour day.

depth equal to almost half the diameter of the disk. The bar machine is essentially a helix carrying cutter bits on its circumference. After being forced endwise under the coal this bar, or helix, is fed along transversely, its action somewhat resembling that of the revolving or drill mortiser sometimes used in woodworking.

In this country two general types of machines have attained success—the puncher and the chain cutter. The first of these has already been mentioned, and its operation, advantages and shortcomings are well known to most mining men. Although a few machines of this kind were built for electrical operation, those now in use are, so far as is known, without exception driven by compressed air. They are virtually air-operated picks mounted on wheels. Their effectiveness in undercutting depends in no small degree upon the brute strength and skill of the men who operate them. It is not without deliberate intention that strength is mentioned first.

This machine, however, possesses three cardinal advantages. It is comparatively cheap in first cost, and the overhead charges on a mine equipped with punchers is in corresponding proportion. The exhaust from such machines aids ventilation and tends to cool the working places where they are used. The undercut made by the puncher is of triangular cross-section, the apex of the triangle being to the rear. This permits the coal to fall readily when shot down and tends to increase the percentage of lump size. The tumble thus given to the coal also shakes it piece from piece, making shoveling easier. Thousands of these machines are still in daily use.

Of the chain cutters three general types are now used: (1) The breast machine; (2) the continuous undercutter, either shortwall or longwall, and (3) the center cutter (including the top cutter) which may make either a circular or a straight-face cut.

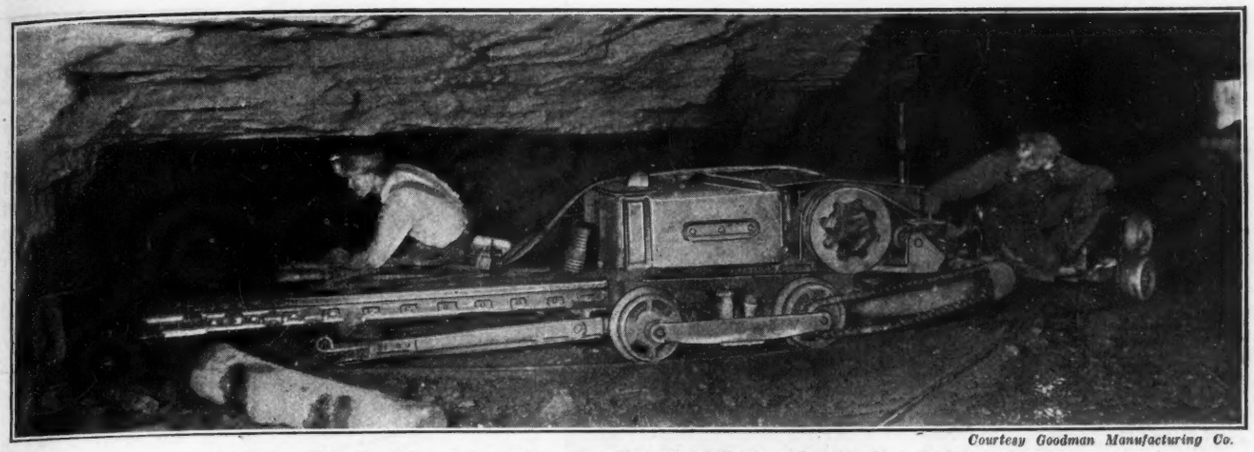
In addition to the above-named types three others have been used to some extent. These include the Hess dustless machine, which is almost identical with the English bar machine previously mentioned; the Jeffrey

Courtesy, Jeffrey Manufacturing Co.

FIG. 3.

Breast Cutter

This cutter has to be sumped into the coal and withdrawn again two, three, four or more times in making a single cut across a face. Between cuts it must be moved over with bars. It cuts only at or near the bottom. Note the bad band at about the level of the man's head. Certain machines, not breast cutters, are constructed to cut such a parting so as to leave the coal clean, and in such a mine there would be no bug dust.



Courtesy Goodman Manufacturing Co.

FIG. 4. SHORTWALL MACHINE ON POWER TRUCK ENTERING A LOW ROOM

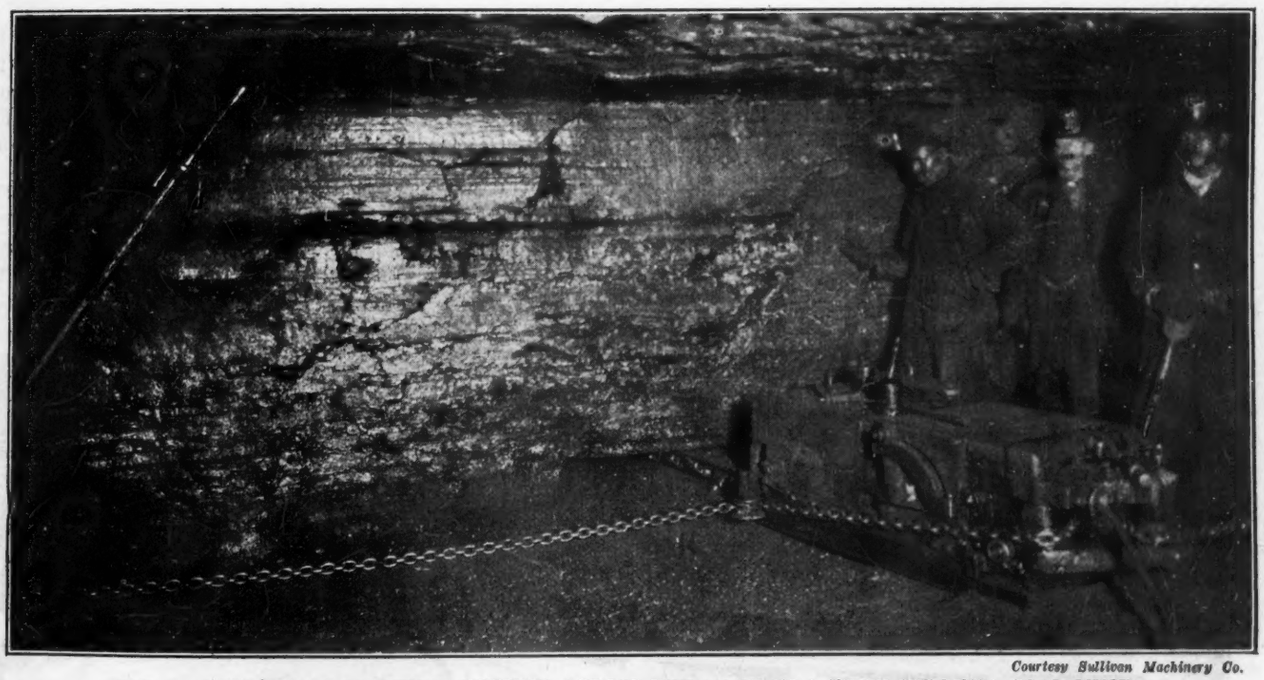
These machines can safely make turns that are but little easier than those laid in mines where mining is done by hand. A reel for the power cable is shown near the rear man. Note the daylight showing at the drift mouth to the right of the illustration. The rock roof is unusually strong for a room so near the surface.

heading machine and the Oldroyd machine. The heading machine is composed of practically three breast machines (one lying flat along the floor and two on edge, one at either side of the bottom cutter), a heavy picking device to knock down the coal and a set of conveyors to remove the mined material and deliver it to a pit car at the rear. This machine is first forced forward into the coal face along one rib, making one bottom and two side cuts. After it has penetrated the coal to the limit of its travel it is withdrawn and moved sidewise a distance almost equal to its own width (about 5 ft.). Here another cut is made. This operation is repeated until the full width of the room or heading has been covered.

The Oldroyd machine in appearance strongly resembles the shortwall undercutter, except that the cutter bar is carried at the end of a set of pantagraph arms which are pivoted to a vertical turntable on the front of the machine body. By this arrangement a cut may be made at any height within reach of the arms. Also a cut may be made in any direction. Thus, if desired, an undercut and any number of shear cuts may be made in the coal face. It is claimed for this machine that it makes a large percentage of lump, as it releases the coal both vertically and horizontally.

The breast machine consists of a horizontal framework that telescopes within a pan and around which a cutting chain revolves. Coal is cut only on the forward end of the frame. In operation a room face is undermined by forcing the frame bearing the chain successively under the face, the machine between runs being moved sidewise a distance equal to its own width.

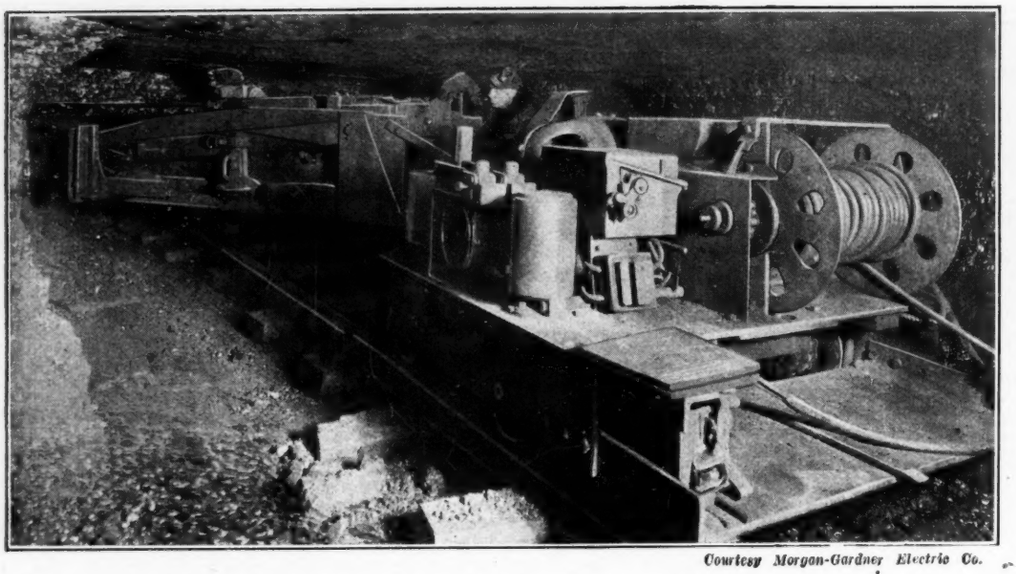
This machine requires much prying about as well as the frequent setting and manipulation of jacks. It



Courtesy Sullivan Machinery Co.

FIG. 5. SHORTWALL MACHINE CUTTING ACROSS THE FACE IN A WEST VIRGINIA COAL MINE

The shortwall cutter sumps itself into the coal face and then cuts from the side, being pulled forward by the steel chain shown, the movement being provided by the machine itself. Where the union does not limit the number of loaders working after a machine, as it too often does, a cutter like this can do much more work than the older type of breast machine. It should be given a lower wage scale than the old-style electric sumping machine.



Courtesy Morgan-Gardner Electric Co.

FIG. 6.

Parting Cutter

This machine cuts at the top or, within limits, at any level lower down. As will be noted, it stays on the rails when cutting and saves the work of loading and unloading at each cut. It is shown in this illustration starting a kerf in a parting a foot or more from the roof.

has been extensively adopted, however, and many thousands are in everyday operation and an appreciable percentage of the bituminous output of the United States is produced by its aid.

In this country much favor has been shown to the shortwall undercutter. In this device the cutter bar, which ranges from 5 to 10 ft. in length, extends forward from the end of the box or case containing the driving motor and mechanism. In operation a sumping cut is made at one side of the room, and after the cutter bar has fully buried itself beneath the coal the whole machine is pulled sidewise across the face to the opposite rib. All movements are made under power.

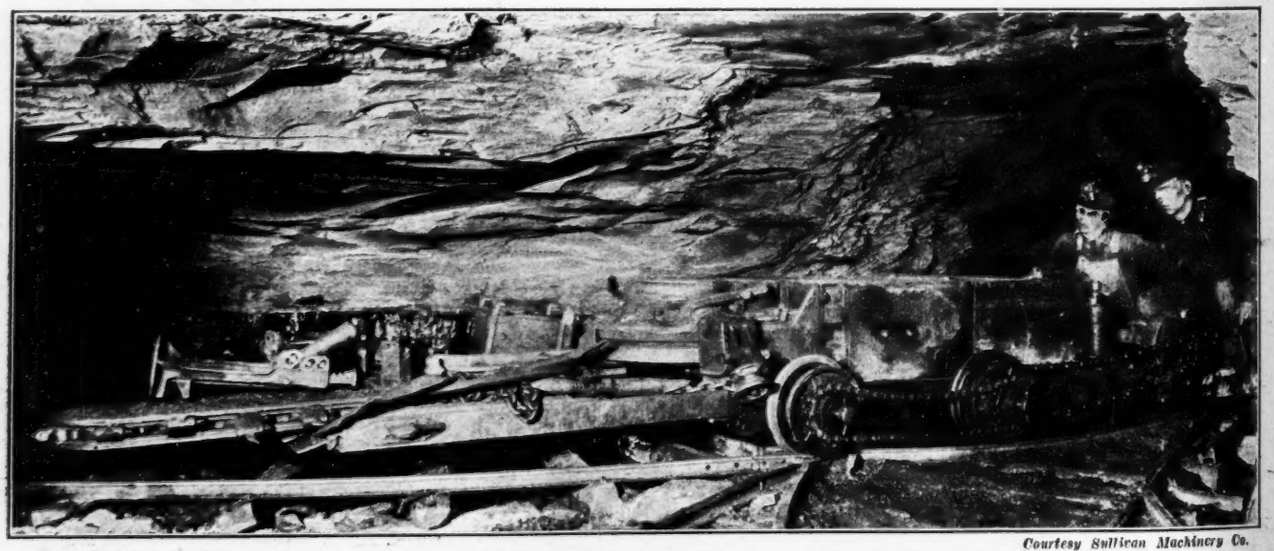
Machine Easily Loaded by Swiveling Skidway

One refinement or comparatively recent addition to the mechanism of this machine is a tilting and swiveling skidway upon the truck that conveys the undercutter from place to place. This permits the machine to be slid off the truck while pointed toward the place where it will sump in. In replacing the machine on the truck it moves up the inclined skidway under its own power in one continuous movement from the face.

The longwall machine is similar to the shortwall except that the cutter bar is hinged to the driving mechanism. By this means the major axes of the machine body and cutter bar may be placed at right angles to each other. In this position the width of the machine from the face amounts to only about 2½ ft., and timbers set with this much clearance need not be disturbed. The resistance to movement also is possibly somewhat less than with the shortwall machine.

Center and top cutters are perhaps the bulkiest and most expensive of the machines intended to merely mine the coal without displacing it or putting it onto a pit car. They are, however, as will be shown later, far more rapid in action than any of the types previously described. Of these the arcwall probably is the best known and most widely used.

This consists of a mechanism strongly resembling a shortwall machine mounted permanently on a truck in such manner that it may be swiveled or revolved by power. It also may be raised and lowered upon its supporting standards under power throughout a considerable range. The maximum width of room that can be driven from a single track with a machine of



Courtesy Sullivan Machinery Co.

FIG. 7. CUTTING MACHINE ENTERING A WORKING PLACE ON ITS POWER TRUCK

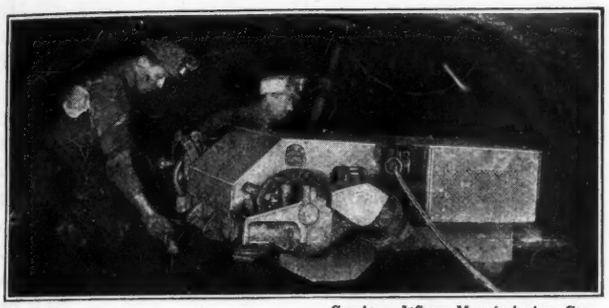
Despite their length and weight these ungainly machines have been so constructed as to enter rooms with comparative ease despite sharp turns and adverse grades. The reel is carried on the trailer in the rear. When this machine is cutting it is only 18 in. high and so can work in extremely low coal without difficulty.

this kind is twice the distance from the center of the turntable to the end of the cutter bar.

The straight-face machine is similar in most respects to the arcwall except that by means of a Y-shaped cam on the turntable the cutter bar is retracted in the center of its sweep across the face so that its end is caused to move in a straight line. The end or face of the place being driven is thus made straight and at right angles to the ribs. It is claimed that with this method of cutting the coal is brought down with less explosive than when the face is curved.

Supplying adequate power wherewith to drive cutting machines is an ever-present and sometimes vexatious problem at the mines. The working faces are almost invariably remote from the source of energy supply, with the result that low voltage is perhaps the rule rather than the exception. This is exactly what might be expected, as the mining machine usually draws its current from the trolley wire, often at points where it is not paralleled by a feeder, and through possibly some hundreds of feet of flexible double-conductor cable.

Recognizing this fact the manufacturers of this type of equipment have built their machines accordingly, with the result that the coal cutters of today are of sufficiently rugged construction to withstand safely the



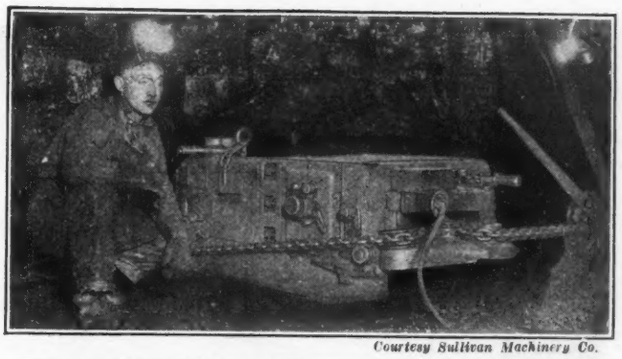
Courtesy Jeffrey Manufacturing Co.

FIG. 8. SHORTWALL CUTTER ENDING CUT

The shortwall cutter keeps closer to the face than the breast machine and so makes it unnecessary to keep a large area unpropped. In this instance a steel rope is used to pull the machine forward against the coal being cut.

rough usage to which they inevitably will be subjected. It is not the intention to suggest by this that these devices are indestructible, as this is by no means the case. As now built, however, they will endure almost indefinitely, ordinary wear and tear expected, the use for which they are intended. Wear of mechanical parts, of course, cannot be avoided, this naturally being most rapid on the picks that do the actual cutting.

Power readings and contrasts of operating time consumed by machines of this kind are likely to be extremely misleading. As one manufacturer puts it, "there are so many variables in this problem that published data would give an erroneous impression almost inevitably and might lead to misconception by the reader. The tendency always is to reason from the particular to the general on data of this sort. The length of cutter bar, the height of the coal, the character of the coal itself, including the presence or absence of impurities, the character of the bottom, the character of the current available (whether alternating or direct) and the voltage, the way in which the cutter bits are kept up or not kept up, the feeding speed used, the general condition of the machine and even the personal equations of the operator and his helper are all items that vary from place to place and from time to time



Courtesy Sullivan Machinery Co.

FIG. 9. CONTINUOUS CUTTER IN A KENTUCKY MINE

This machine uses a chain to pull it forward to its work. The links of this chain rest in suitable pockets cast in the periphery of the pulleys by which it is actuated.

even in the same mine or in the same part of the same mine."

Now, suppose that the power and the time consumed in an operation of this kind, these amounts depending entirely on the various conditions encountered, are noted under particularly favorable circumstances. In such a case, from the standpoint of both power and time, the record would be good. In considering other mines, however, where the conditions were less favorable such results would be valueless. Even figures on average time of cutting and power consumption might be highly misleading.

As a result of these considerations and their obvious consequences too much dependence should not be placed in the figures here presented. These records, however, have been drawn from several sources and are believed to be typical of the results obtained in the mines specified.

Thus the Consolidation Coal Co. reports from Jenkins, Ky., as follows concerning its operation of the arcwall machine: "We have cut as many as sixty places with one machine in one shift, but as a rule we average cutting from thirty to thirty-five. The machine used has an 8-ft. cutter bar and makes a cut of this depth in a parting from 33 to 35 in. from the bottom. The power consumed varies with the character of this parting. In most places it is soft and no more power is required than is consumed by an ordinary shortwall machine when cutting in coal.

"The rooms are necked by the arcwall machine in the ordinary manner. They are driven from 12 to 15 ft. wide and the coal after being cut in the center of the bed is shot in two benches. Usually three holes are placed in the bottom bench and two in the upper one. If the coal is undercut three holes are required. When cut in the center, one center and two rib shots are necessary in the lower bench and two rib shots suffice for the upper one."

One objection sometimes raised to the employment

Courtesy Goodman Manufacturing Co.

FIG. 10. ALTERNATING-CURRENT COAL CUTTER

Cutting the coal face at the Tarnay Collieries Co.'s mine at Matewan, W. Va.

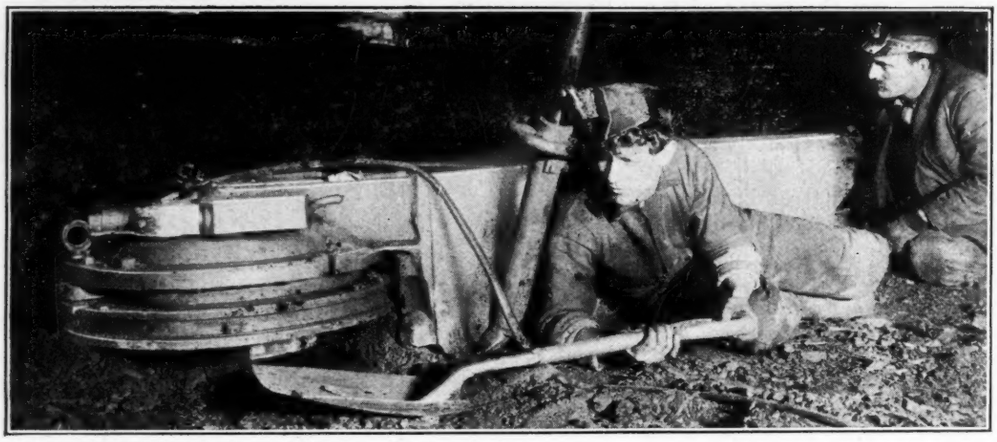


FIG. 11.

Longwall Cutter

This machine hugs the coal so closely that posts can be set only a few feet from the face. It will work in the lowest of coal, crawl up difficult grades, and few places are so tight that it cannot worm its way through. When at work the cutter bar and machine body stand at right angles to each other.

of the arcwall machine (but which probably is not peculiar to this type of coal cutter) is the difficulty experienced in making it cut out a parting if it be both hard and narrow. Just as an ordinary handsaw cutting soft wood with the grain will tend to deviate from a straight course when it encounters a hard layer nearly parallel with its cut, so the cutter bar tends to push out of a band of hard bone and operate in the softer coal.

Breast and Shortwall Results in Illinois

Results obtained by the Peabody Coal Co. on breast and shortwall machines in certain of its mines in southern Illinois are shown in Table I. The breast machine operating at mine No. 11, at Kortkamp, was cutting in the No. 6 bed of Illinois, which is reported to be of medium hardness. It does not contain nearly as much sulphur, or blackjack, as is found in the Kincaid mine.

Both of the other machines operated in mine No. 7, at Kincaid, where also the No. 6 bed in the Illinois series is being worked. The cutting is said to be about as hard as is found in any mine operated by this company, sulphur balls and blackjack being frequently encountered. In addition to the data given in the table it is reported that the power consumed in moving the shortwall machine from room to room amounted to from 0.4 to 0.7 kw.-hr. per place. That consumed in sumping amounted to from 0.85 to 0.9 kw.-hr. in each case.

In Table II are assembled results obtained by the Consolidation Coal Co. with breast machines fitted with coal-boring augers for putting in shotholes. These figures show wide variations in power consumption. Especially do they show that as the amperage consumed by the machine goes up the voltage goes down, or vice versa. When the potential of a 250-volt circuit sinks to 70 to 80 volts, as is shown in certain instances in this table, excessive current is drawn from the line.

Fig. 12 shows rough graphs of the power consumed by these breast machines while cutting. The ordinates of these curves are horsepower consumed—that is, the product of observed voltage and amperage divided by 746, while the abscissæ are merely successive observations from start to finish of the run. From the tabulated observations all figures recording consumption while boring shotholes, running light, and backing out have been eliminated, so that the curves show the power required for cutting only. In both cases the bits were sharp at the start.

Numerous observations on the shortwall undercutter

TABLE I. RECORD OF THREE TESTS OF MACHINES IN MINES OF THE PEABODY COAL CO.

	Type 119 Breast Machine, 3 ft. 11 in. x 6 ft. 0 in. Cutter, 4½ in. Kerf, at Mine No. 1 Kortkamp, Ill.	Type HHD Breast Machine, 3 ft. 4 in. x 6 ft. 0 in. Cutter, 3½ in. Kerf,* at Mine No. 7 Kincaid, Ill.	Type CE 7 Shortwall Machine, 6 ft. 6 in. Cutterbar, 5½ in. Kerf,† at Mine No. 7 Kincaid, Ill.
Number of runs made	12	11	6‡
Av. time of cutting in each run	4 min.	4 min.	49.1 min.§
Av. time backing out of each run	½ min.	1 min	....
Av. depth of cut	5 ft. 6 in.	5 ft. 6 in.	5 ft. 10½ in.
Av. width of cut	3 ft. 2 in.	3 ft. 2 in.	34 ft. 1½ in.
Av. area undercut	17.4 sq.ft.	17.6 sq.ft.	199.1 sq.ft.
Av. voltage	250	229	266
Av. kw.-hr. consumed per cut	0.92	1.18	9.66
Av. watt-hr. per sq.ft. of cut	49.	66.	48.5
Av. height of coal	7 ft.	7 ft. 6 in.	7 ft. 6 in.
Kw.-hr. consumed per ton	0.19	0.24	0.175
Av. kw.-hr. consumed cutting in	0.85	1.07	....
Av. kw.-hr. consumed backing out	0.06	0.11	....
Time unloading per room	....	4.5 min.	....
Time loading per room	....	4 min.	....
Av. time of moving	....	....	25 min.
Time of unloading and setting up	....	....	75 min.
Time of loading	....	....	9.2 min.
Av. No. of bits used	....	....	55.5
Av. tons cut	....	....	55.4
Av. No. of bits used per ton	....	....	1

* Five-position chain with pick-point bits used
† Seven-position chain with pick-point bits.
‡ In this case each run means a room cut.
§ This includes sumping 9.5 min. and cutting across face 39.6 min.

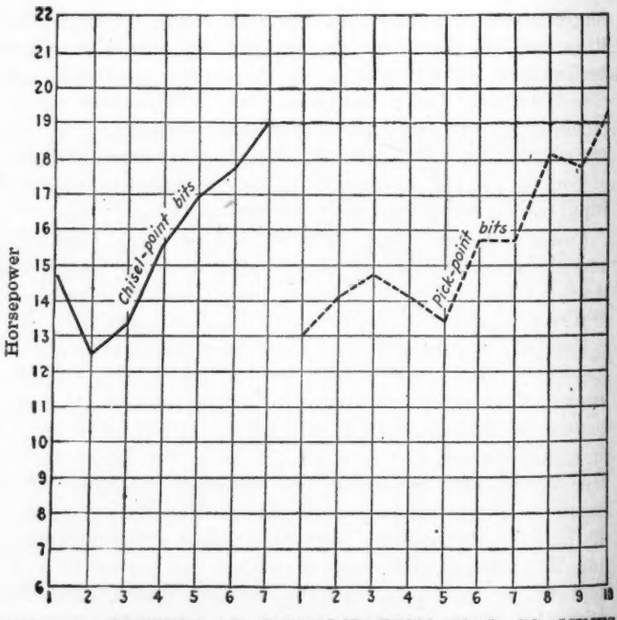
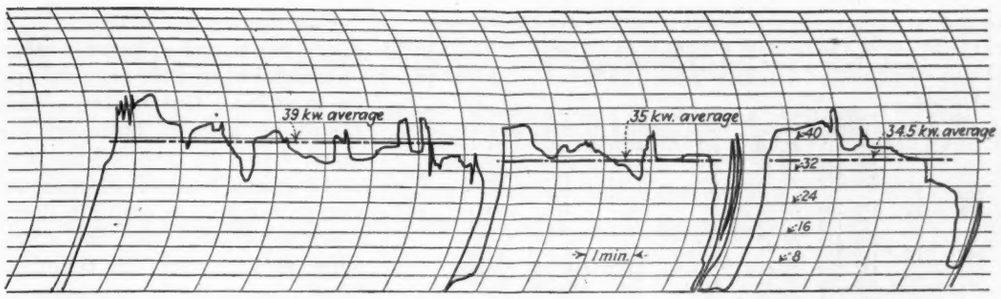


FIG. 12. RESULTS AT CONSOLIDATION COAL CO. MINES

Abscissae show successive observations, time not stated. Ordinates show horsepower consumed. Results are given for chisel- and pick-point bits.



Courtesy Jeffrey Manufacturing Co.

FIG. 13.
Breast Machine Cut
Cutting coal in three sumps. The curved ordinates represent kilowatts of power used at any given time during the cut.

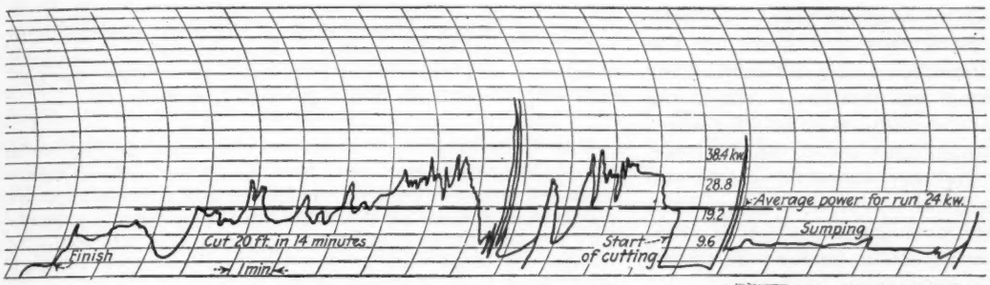
made in various mines show about the following results: A machine provided with turntable truck and tilting platform ordinarily is unloaded in about one minute. It takes from one to two minutes to set jacks and get ready to make the sumping cut. It requires about one and one-half minutes to sump, after which the machine is fed across the face at the rate of from 20 to 24 in. per minute if the cutting is easy and about 17 in. per minute if the coal is hard, or somewhat less if the voltage is low. After the undercut is complete the machine is drawn back to the truck at the rate of 20 ft. per minute. Loading takes from one to two minutes and moving along the track from place to place is done at the rate of about 300 ft. per minute.

Observations on the power consumed by coal-cutting machines show that on the average about 40 watt-hours are required per square foot of floor area covered. In easy cutting this may fall to as low as 30 watt-hours and in hard material it may go as high as 55 watt-hours or more. In rock or other impurities the power consumption may run considerably higher. Both shortwall and arcwall cutters when at work will require on the average about 120 amperes at 250 volts.

Fig. 14 shows the power consumed by a shortwall machine equipped with an alternating-current motor while operating in the Island Creek coal bed at Omar, W. Va. The cutting encountered at this mine is classed as "average hard" and the input averaged 24 kw. Fig. 15 is a record of the input to a shortwall machine equipped with a direct-current motor when operating in easy cutting. Here the input averaged 20.6 kw.

Fig. 13 is the input to a machine operating in the same mine as the one shown in Fig. 15. In this instance, however, the cutting was extremely hard, as the machine worked into the bottom and was operating in rock. This condition is not infrequently encountered.

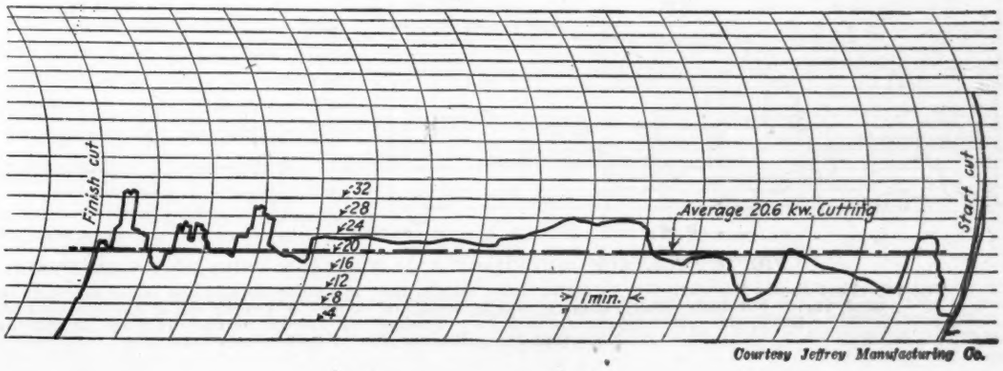
In Fig. 16, curve *A* shows the average voltage condition prevailing in a typical 250-volt mine. It should be noted that the potential while cutting averaged only 175 volts at the machine. Curve *B* shows the input to the undercutter in amperes. The cutting done at this mine was recorded as "easy," and the machine was in good condition. Curve *C* shows the power consumption in kilowatts. All three of these curves were taken simultaneously on the same machine. It will be observed that about 10 per cent discrepancy exists between the average kilowatt consumption and the volt-ampere records. This was caused by the zero errors in the recording meters and the slight inaccuracies existing in portable instruments of this type.



Courtesy Jeffrey Manufacturing Co.

FIG. 14.
Shortwall Cut
Sumping cut takes only about 10 kw., and the average power consumption for the straight-away cutting is 24 kw.

Of the chain undercutters the breast machine was the pioneer. The advent of the shortwall, or, more strictly speaking, the continuous cutting machine, brought a powerful rival into the field. For a long time the breast machine was considered the more advantageous type to use in narrow places, but this advantage, if ever really possessed in actual practice, has now been largely neutralized by the introduction of the tilting and swiveling truck. When it is possible with the shortwall



Courtesy Jeffrey Manufacturing Co.

FIG. 15.
Another Shortwall Cut
Here the average wattage used is 20.6. The momentary peak is 56 kw. The place is cut in sixteen minutes.

TABLE II. OBSERVATION OF VOLTAGE, AMPERAGE AND CUTTING TIME USING BREAST MACHINES AND AUGERS

Running Light		Full Load		Backing Out		Auger		Time of Run, Min.
Volts	Amps.	Volts	Amps.	Volts	Amps.	Volts	Amps.	
	..	200–210	40–50	225	20–25	225	25	..
	..	200–215	40–55	..	..	..	..	..
	..	200–210	40–55	225	20–25	225	25	4
210	25	..	..	200–210	20–25	190	40	..
205	20	175–200	40–60	205	30	205	35	4½
	..	155–190	50–75	200	25	..	..	
	..	200–235	32–50	..	..	..	..	..
240	10	160–230	30–50	240–250	10–15	170–240	10–20	..
	..	130–220	30–65	220	15	210–230	15–25	..
	..	210–220	25–35	180	25	220–230	20–25	..
	..	80–175	40–60	210	24	190	27	8
	..	70–175	50–75	160	25	180–200	20–30	..
	..	210–220	40–50	..	..	225	28	4
215	25	150–190	42–80	210	32	170–200	35	..
	..	60–190	55–125	215	25	..	..	..
	..	100–200	30–85	155	45	200	30	4½
	..	160–225	50–105	220	50	225–230	30–40	4½
	..	150–240	25–100	225–230	30	220–230	30–35	4½
	..	200–250	20–75	230	25	..	..	4½
230	20	175–210	50–70	..	..	225	35	4½
	..	185–200	70–80	210	50	210	45	4½
	..	190–225	35–70	245	20	..	..	4
270	20	260	50	..	..	..	..	..
265	25	225	70	..	..	..	..	..
230	20	195–220	45–60	220	25	..	..	..
	..	165–225	50–90	250	25	240	30	4
	..	140–180	45–70	200	30	175	50	7
	..	135–180	49–72	185	40	125–165	30–40	..
233	20.6	..	..	..	..	..	..	..

machine to unload, cut a place, reload and move out into the entry again, all within the space of 17 minutes, as has been done repeatedly, little if any advantage remains to the breast machine.

On the other hand, adoption of the continuous cutter, whether of the shortwall or arcwall type, has been impeded by reason of restrictions laid down by the miners' union. In many localities a fair differential for the mining machine cannot be obtained. When the union demands that only a certain number of loaders may be employed for each machine—seven, ten, fourteen or whatever this number may be—based on puncher or breast-machine operation, little incentive is offered for the installation of a modern undercutter, which, if properly scheduled, can mine as much coal as forty-five to fifty shovelers can load out.

Few figures are available on the amount of coal produced per pound of powder when undercut by hand pick as compared to that produced per pound when undercut by machine. One of the reports of the State Mining Board of Illinois, however, shows that this ratio is about 4 to 1 in favor of machine cutting. Pick mining is laborious work and consequently the hand miner is always tempted to drill his shotholes deep so as to bring down some coal from the solid. This may account in some measure for the comparatively poor showing of hand mining in the consumption of explosives.

In conclusion it might be said that all experience has shown that it pays to displace human energy with mechanical energy—to substitute a machine for a man wherever this can be accomplished successfully. The production of coal is no exception to this rule and little question exists today concerning the utility of the mining machine of modern type. Unfortunately, however, trade unions, particularly those composed of unskilled or only semi-skilled workers, through a perverted conception of economics and a distorted idea of what is to their own as well as the general advantage, are not infrequently inclined to "buck" the adoption or restrict the use of such labor-saving devices.

THE PRELIMINARY DRAFT of a proposed schedule to cover tests of mine telephones to determine their permissibility for use in gaseous mines has been prepared by the U. S. Bureau of Mines. The schedule is based on experiments at the Pittsburgh station, which proved that under certain atmospheric and mechanical conditions an electric spark of sufficient intensity to ignite gas could be produced.

THE U. S. BUREAU OF MINES is collecting data relative to the use of brattice cloth in mines. At present little is known as to the amounts used, or the life of different cloths under different conditions of use, although the aggregate expenditure for this purpose is large. Samples of cloth used at a number of large coal mining plants in western Pennsylvania have been obtained by the bureau.

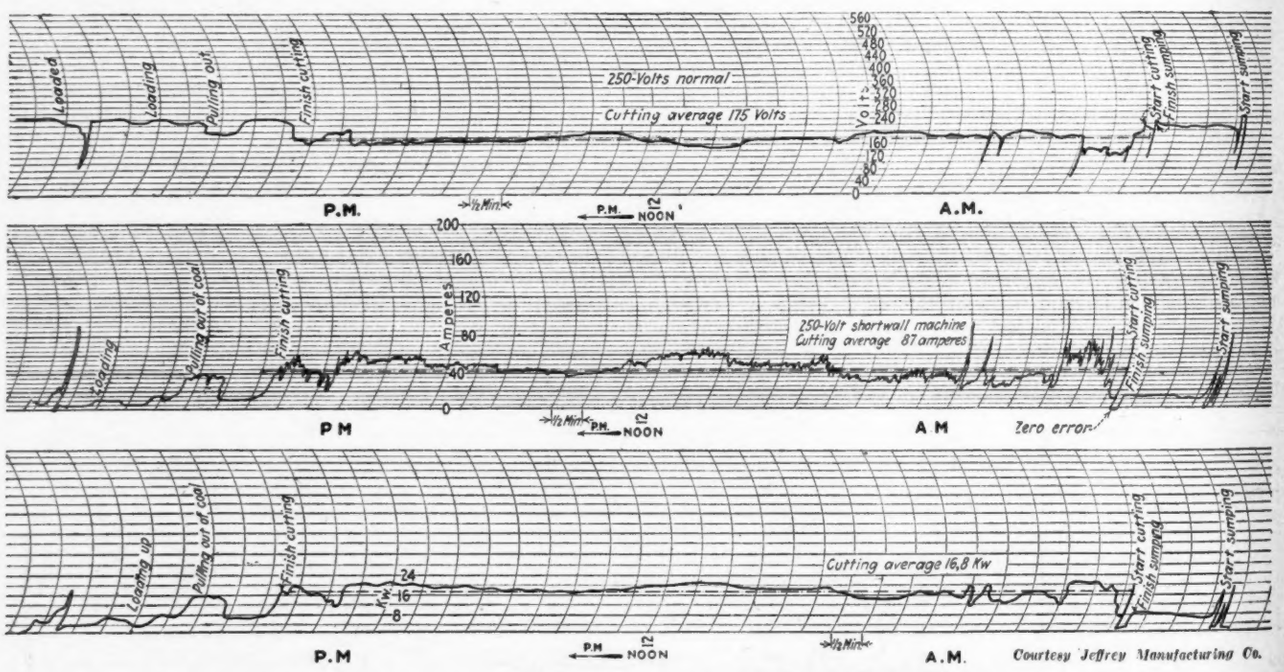


FIG. 16. VOLTAGE, AMPERAGE AND WATTAGE USED IN A SHORTWALL CUT

The top chart shows the variation in voltage, the middle that in amperage and the lower one that in wattage. The power used varies but little after sumping and is small, of course, in pulling out of the coal and loading up on the truck, the latter taking about 8 kw. The cutting average is only 16.8 kw. in this instance. Note that the ordinates are at half-minute intervals.

Records at Kathleen Mine Show That When Running Time Is Halved Power Costs Per Ton Mined Are Doubled

How Steady Runs Lower Power Cost—Power Used for Various Services Is Tabulated Just as Labor Costs Are Distributed on Rolls—Sectional Meters Will Check Power Purchased

BY EUGENE MCAULIFFE*
St. Louis, Mo.

MOST coal companies now make some attempt to ascertain and to record the cost of the power consumed in the various phases of mine operation. In many instances an accurate determination of the various items can be obtained only with difficulty because the power for locomotives and mining machines as well as for pumping is generated at the mine and the output of the power plant is distributed to two or more developments without any attempt to make the primary and secondary meterings that are necessary where the power consumption of any operation is to be determined. This situation is in many instances further complicated by the joint use of both steam and electric energy.

Most coal mines that use steam power generate it from the coal they produce. In consequence the coal actually burned is not properly measured and the fuel consumed is not charged at its true market price. In most cases both the weight of the fuel burned and its value are determined empirically. For this reason the cost of power cannot be gaged with accuracy.

A statement showing how the power was used in the different processes of mining during the coal year from April 1, 1921, to March 31, 1922, for the Kathleen Mine of the Union Colliery Co., at Dowell, Ill., is presented herewith. This offers an opportunity to analyze the cost of individual processes. It also presents some interesting records of the effect of low tonnage and short working time on unit power costs.

STEADY RUN TENDS TO REDUCE POWER COST

Whenever a reasonably steady run can be obtained in the coal-mining field, the cost of power will be reduced by that fact in the same proportion as other items of expense. It will be noted in the distribution sheet that with 9.69 working days in July, 1921, the cost of power at this mine amounted to 13.36c. per ton of coal produced, whereas in March, 1922, when the mine worked 21 days, the power cost was only 6.43c. per ton.

Had it been possible to maintain the March cost throughout the entire year, the total power bill would have been reduced by $14,107.51. On the other hand, had the cost for power obtaining in July, 1921, or 13.36c., been carried through the production of the year, this amounting to 468,688 tons, the sum paid would have exceeded the expense entailed by the low-cost power of March by $32,480.08.

At this mine steam is used only for heating the various buildings and warming the water used in the washhouse. Below ground the equipment consists of fourteen 6-ton 250-volt direct-current trolley gathering locomotives, two 15-ton haulage locomotives operating on the same current and voltage, eighteen shortwall mining machines driven by 220-volt alternating current and four breast machines taking this same current and potential.

Above ground the equipment embraces one 600-hp. 500-volt motor drawing direct current from a 500-kw. 2,200-volt alternating-current motor-generator set equipped with liquid rheostat and a 10-ton flywheel. The direct-current motor is geared to a cylindro-conical drum, the hoist operating two 10-ton skips. The man-and-material hoist consists of a 250-hp. 2,200-volt alternating-current motor geared to a cylindrical drum operating a counterweighted cage. A 50-hp. 220-volt alternating-current motor is belted to the ventilating fan. When necessary, this will be replaced by a machine of larger capacity. The tipple machinery, the shops and the pumps are all operated by alternating current at 220 volts, the motors for driving the various machines or groups of machines ranging in size from 3 to 30 hp. All alternating current is 3-phase, 60-cycle.

The shortwall mining machines are fitted with cutter bars 7 ft. 6 in. long and those of the breast machines are 6 ft. in length. The average thickness of the Illinois No. 6, or Herrin, coal bed, which is worked at this mine, is 8 ft. 6 in. From 6 to 7½ ft. of coal ordinarily is removed in entries and rooms, the remainder being left up for roof protection. In undercutting, the machines keep from 2 to 4 in. above the relatively hard fireclay floor, leaving the bottom coal for the miners to lift. This they do without difficulty. By this procedure the coal as produced is free from fireclay and other bottom impurities. Taken as a whole, the conditions for undercutting are quite favorable.

Conditions encountered in the underground haulage at this operation are comparatively difficult. This is

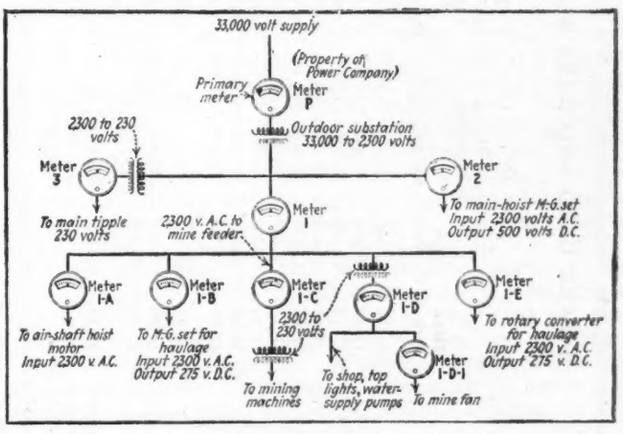

33,000 volt supply
(Property of Power Company)
Primary meter
Meter P
Outdoor substation 33,000 to 2300 volts
2300 to 230 volts
Meter 3
Meter 2
To main tipple 230 volts
2300 v. A.C. to mine feeder
Meter 1
To main-hoist M-G. set Input 2300 volts A.C. Output 500 volts D.C.
Meter 1-A
Meter 1-B
Meter 1-C
Meter 1-D
Meter 1-E
To air-shaft hoist motor Input 2300 v. A.C.
To M-G. set for haulage Input 2300 v. A.C. Output 275 v. D.C.
2300 to 230 volts
To rotary converter for haulage Input 2300 v. A.C. Output 275 v. D.C.
To mining machines
To shop, top lights, water-supply pumps
Meter 1-D-1
To mine fan

FIG. 1. CHART OF METERING ARRANGEMENTS, KATHLEEN MINE

These meters make it possible to ascertain where the power purchased goes, a necessary preliminary step that must be taken if power leaks are to be stopped. Knowledge concerning present costs is the only firm foundation on which to build plans to reduce costs in the future.

*President, Union Collieries Co.

POWER USED AND DAYS WORKED IN ONE COAL YEAR, WITH DISTRIBUTION OF POWER INTO ITS VARIOUS USES, KATHLEEN MINE, DOWELL, ILL.

	Days Worked	Tons Produced	Mining Machines		Gathering and Haulage Locomotives		Main Hoist		Tipple Machinery		Mine Fan		Man-and-Material Hoist		Shop-Top Lights and Water Supply		Transmission and Transformation Losses		Total Power Purchased 100%	Kw.-hr. Per Ton	Cost Per Kw.-hr.	Cost of Power Per Ton
			Kw.-hr.	Per Cent	Kw.-hr.	Per Cent	Kw.-hr.	Per Cent	Kw.-hr.	Per Cent	Kw.-hr.	Per Cent	Kw.-hr.	Per Cent	Kw.-hr.	Per Cent	Kw.-hr.	Per Cent				
1921																						
April	13.13	27,106	12,840	10.6	48,838	40.3	15,030	12.4	4,688	3.9	23,200	19.2	4,480	3.7	2,560	2.1	9,503	7.8	121,139	4.70	$.0256	$.1204
May	12.50	29,685	13,840	11.6	51,074	42.8	14,535	12.2	4,656	3.9	23,000	19.3	3,720	3.1	1,980	1.7	6,464	5.4	119,269	3.87	.0280	.1070
June	12.12	29,924	14,000	11.5	54,500	44.6	14,655	12.0	4,544	3.7	21,600	17.7	3,840	3.2	2,160	1.8	6,728	5.5	122,027	3.67	.0285	.1045
July	9.69	23,653	16,600	14.9	43,988	39.4	11,655	10.5	3,888	3.5	22,000	19.7	3,400	3.0	1,760	1.5	8,387	7.5	111,678	4.72	.0284	.1336
August	11.00	32,259	14,640	11.4	56,212	43.7	15,795	12.3	5,056	4.0	21,900	17.1	3,600	2.8	1,860	1.5	9,249	7.2	128,312	4.19	.0263	.1102
September	12.19	36,859	16,800	13.0	58,418	45.3	17,205	13.4	5,632	4.3	21,110	16.4	4,240	3.3	2,260	1.7	3,294	2.6*	128,959	3.38	.0285	.0969
October	19.50	58,237	24,880	13.3	83,059	44.5	27,555	14.8	11,456	6.1	23,800	12.7	5,160	2.8	2,760	1.5	8,001	4.3	186,671	3.61	.0214	.0774
November	10.94	34,321	14,960	11.0	57,119	42.0	16,270	12.0	4,112	3.0	22,300	16.4	4,360	3.2	3,460	2.5	13,444	9.9	136,025	3.47	.0302	.1047
December	11.00	36,103	16,760	12.0	57,947	41.4	16,870	12.0	5,920	4.2	24,000	17.1	3,840	2.7	2,880	2.1	11,912	8.5	140,129	3.38	.0300	.1014
1922																						
January	12.56	43,330	18,000	12.0	61,570	41.2	19,400	13.0	7,200	4.8	24,500	16.4	3,800	2.5	3,100	2.1	12,022	8.0	149,592	3.83	.0251	.0964
February	14.00	46,919	20,960	13.5	68,090	43.8	22,120	14.2	7,376	4.7	19,400	12.5	4,320	2.8	5,000	3.2	8,264	5.3	155,530	3.15	.0267	.0842
March	21.00	70,292	28,120	13.3	99,708	47.1	32,360	15.3	11,696	5.5	21,000	9.9	5,880	2.8	6,440	3.0	6,486	3.1	211,690	2.83	.0227	.0643
Totals and averages	159.63	468,688	212,400	12.4	740,523	43.3	223,450	13.1	76,224	4.4	267,810	15.7	50,640	2.9	36,220	2.1	103,754	6.1	1,711,021	3.65	$.0259	$.0944
Average kw.-hr. per ton			.45		1.58		.48		.16		.57		.11		.08		.22		3.65			
Av. cost of power, per ton			$0.0116		.0409		.0124		.0041		.0148		.0028		.0021		.0057		.0944			

* Primary meter broken down part of month. Consumption during period of disablement estimated.

particularly true with respect to the control of loaded trucks moving toward the shaft bottom on a descending grade of 7 per cent. As the mine is new, the extreme length of haul is approximately 3,600 ft., and the average is about 2,600 ft. The grades, which favor the loads, are such as to restrict a full trip to a maximum of fifteen cars, although additional wagons may be handled by the aid of skid shoes. The cars used at this mine are of 42-in. track gage and weigh 4,200 lb. each. They are of wooden construction, fitted with roller-bearing trucks and wheels 16 in. in diameter. The gathering locomotives place these cars at and remove them from the working faces, automatic reels and cables being used for entering the rooms.

In considering the energy consumed and the cost per ton resultant upon the use of gathering and haulage locomotives, this power amounting to 43.3 per cent of the total, due allowance must be made for the fact that secondary transmission losses occur as a result of converting 2,300-volt alternating current into 275-volt direct current. Line losses on the mine bottom, both primary and return, also are material, because of the usual difficulty encountered in maintaining the low-voltage trolley line and the return in good condition. As the result of providing adequate primary and return feed lines, however, the direct-current potential at the points most remote from the generators seldom falls below 200 volts.

Power Delivered at Potential of 33,000 Volts

Power is purchased and delivered to the mine at a potential of 33,000 volts. The metering diagram, Fig. 1, indicates the pressures at which the power is consumed and measured. A study of this arrangement shows that transmission and transformation losses occurring between the power company primary meter (*P*) and the submeters installed by the coal company are all measured except those resulting from conversion by means of the motor-generator and rotary-converter sets and the transmission to underground substations and transformation at these points of the energy used by the mining machines.

All submeters owned by the company are located in an indoor substation, from which 230-volt alternating current is transmitted to the main tipple machinery, to the shop and the lighting load, as well as to the mine fan, all of which are located within 300 ft. of the meters. Furthermore 2,200-volt alternating current is transmitted to the main hoist, to the mining-machine meter, the motor-generator set and rotary converter for direct-current haulage supply and to the man-and-material hoist motor. The main portion of this load lies within the airshaft hoist house.

The tabulation of results derived from this metering arrangement furnishes some interesting facts: (1) It shows clearly the relation of work, time and tonnage to power cost, this latter ranging from 6.43c. to 13.36c. per ton of coal produced. When the mine has attained its full growth this effect will be further enhanced, because the power schedule, as is common practice, contains a demand or service charge as well as an energy charge per kilowatt-hour consumed. The demand charge is not reduced during months of low production, and in consequence contributes substantially to the high power cost per ton. As the capacity of the mine and the connected load increase, the demand charge also will increase. (2) Haulage is the greatest power-consuming

process that the coal passes through. The tabulation indicates that more power is consumed in transporting the coal than is required for the sum of its cutting, hoisting and preparation. (3) The ventilating load is remarkably constant, varying practically in accord with the number of days in the month. (4) Employing a metering arrangement of this nature permits a close check of the correctness of the power company's bill. Meters owned by this company are read daily, and in case of breakdown of an individual meter, this record is of value in the determination of correctness.

The power consumed at the Kathleen Mine is purchased from a public utility serving a large number of operations. In order to make possible a comparison for determining the desirability of electric installation, the existing authorized public tariff is set forth as follows: Demand charge for first 200 kw. of maximum demand, $2.40 per kilowatt per month. For all demands in excess of the above $1.95 per kilowatt per month. The energy charge is as follows: First 1,000 kw-hr., per month, 6c.; next 2,000 kw-hr., 4c.; next 2,000 kw-hr., 3c.; next 20,000 kw-hr., 1.7c. All energy in excess of the amounts above enumerated is at the rate of 1.3c. per kilowatt-hour per month.

The service so far rendered has entailed many interruptions necessitating frequent applications of the steam auxiliary fan drive. Serious operating and maintenance losses also have been sustained.

Steam, Air and Water Lines Can Be Closed From a Distance by Electric Current

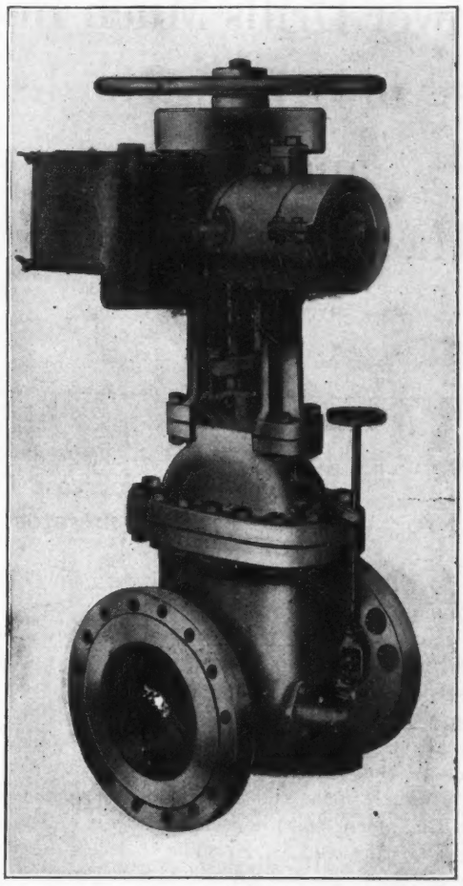
NEED for a type of valve capable of remote electrical control long has been recognized. This need obviously is particularly urgent in time of accident, as upon such an occasion manual methods of valve closure are not only slow and extremely hazardous but are sometimes utterly impossible. It is unnecessary therefore to dwell upon the advantages inherent in the expeditious control of valves in steam, air or water lines carrying heavy pressures when such control may be effected from a safe distance.

Up until the time when certain tests were made upon electrically controlled gate valves by the Public Service Electric Co., at Newark, N. J., a reasonable degree of doubt existed in the minds of engineers generally as to the reliability of such a mechanism under the extreme conditions occasioned by the rupture of a steam pipe. The tests in question demonstrated, however, that a valve if properly designed and constructed would function reliably even under these severe conditions.

Upon the occasion referred to the test was made on a Lunkenheimer 10-in. cast-steel monel-mounted Victor gate valve equipped with Dean electric control. This device successfully closed in less than 30 seconds against steam at 225-lb. pressure and carrying 150 deg. F. of superheat. The discharge end of the valve was open to the atmosphere and the steam was allowed to flow for one and one-half minutes before closure of the gate was attempted.

After the test the seat and disk rings were carefully examined to ascertain the extent of the damage, if any, that had been done. The various parts, however, were found to be in perfect condition and showed no marks such as would have been caused by the disks dragging across the seats as a result of improper guidance.

Valves of this kind are now procurable in either iron or steel body in sizes of 6 in. and larger. They may be made to operate from as many different control stations or points as desired. The valve shown in the accompanying illustration is intended for a working steam pressure of 350 lb. and a temperature not exceeding 800 deg. F. Valves of this type, either with or without bypass, are recommended for installation in boiler leads, for sectionalizing the main header or upon individual lines to the various prime movers in a steam plant.



VALVE EQUIPPED FOR REMOTE CONTROL

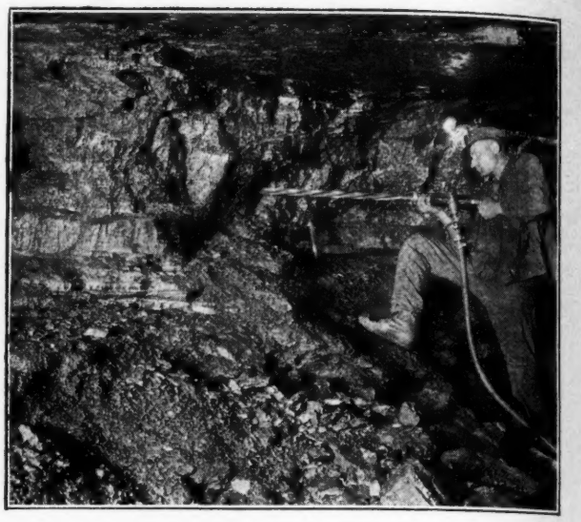
Many mines have valves that should be capable of being put in operation from a distance. Some are too distant or too near escaping water or steam to be quickly or safely closed. This valve is equipped with a device that makes closure under those conditions safe, quick, easy and certain.

A detailed report of government savings during the year which will end June 30, 1922, was transmitted to Congress May 8 by the President, showing fuel savings, among others. In the Public Health Service a saving of $13,500 in fuel is noted. In fuel storage at the Mare Island (Cal.) Navy Yard, a saving of $393,427 is reported, and $15,000 at the Melville (R. I.) coal depot. In the Bureau of Mines $1,629 was saved from the appropriation made for testing fuel. The navy closed the South Boston fuel depot, saving $50,000; the South Charleston fuel depot, saving $32,000; partially closed the Newport News fuel depot, saving $2,000, and partially closed the Constable Hook (N. J.) fuel depot, saving $105,000. Authority has been requested to close the navy fuel depot at Newport News, Va., and to dispose of the coal at that station. A cheaper grade of coal for use at navy power plants at shore stations is being purchased and substantial economies effected thereby.

PROGRESS IS BEING MADE by the U. S. Bureau of Mines in obtaining more definite information regarding the subject of mine subsidence, in connection with coal mines as well as in Michigan iron mines and in certain Western copper mines.

Power Drills Much Reduce Costs of Drilling Harder Coals and Lower the Hazard Costs of Mining

By Newell G. Alford*
Pittsburgh, Pa.



Where Car Supply Is Adequate and Men Can Load Steadily Power Drills Increase Output—Portable Air Compressors and Motor-Generator Sets—Records of Performance

WHEREVER the coal to be shot down in mining is of a medium to a hard texture or where sulphur balls frequently occur, the availability of the power drill as a means of reducing the cost of drilling is most keenly appreciated. The power drill also particularly commends itself wherever the supply of mine cars is so ample that the miner could continue loading all the day long if he did not have to stop to drill. In such cases the advocates of the use of power for drilling urge that there is a saving of the time lost in hand drilling and an increase in the quantity of coal which a loader can put on the cars. Furthermore it is urged that by more uniform and more intelligent methods the hazards of mining are much reduced.

In central Pennsylvania portable air drills are supplied from portable air compressors that deliver the air at a pressure ranging from 80 to 90 lb. per square inch. These are driven with 12½-hp motors. At one mine which is equipped with 440-volt alternating current an electric drill is used. At plants equipped with electric current it has been found, after much experimentation, that air drills are not as economical as those driven by electricity, but difficulty will be found in obtaining an electric drill that will operate satisfactorily on 550-volt current.

Where coal is unusually hard it is good practice to use a portable motor-generator set or a motor-driven compressor. While these means of obtaining the requisite power are more costly than more direct methods, owing to the loss in the transformation of energy, they are more justifiable with hard coal because by their use the energy imparted is greater and the drilling speed is increased.

At one plant an electric drill was used having an auger advance of 37.4 in. per minute and a threadbar with a No. 10 thread. When this machine operated at 224 r.p.m. on 250-volt direct current, boring a hole 2 in. in diameter, holes 6 ft. deep were drilled in an average time of 3.6 minutes, exclusive of the time consumed in loading, unloading and transferring. In this case augers 3 ft. 6 in. long were used in drilling the first half of the hole and an extension bit 6 ft. 6 in. long was then put in the machine to complete the hole. As an average three minutes was consumed in making power connections, unloading the drill from the truck and setting up the machine for the first hole. After drilling the three to five holes which sufficed for the shooting of the working face, an average of 2.7 minutes was taken to disconnect the power and load the equipment before transferring to the next place. The power consumption was 0.038 kw.-hr. per ton drilled. The table accompanying this article shows the results obtained in several mines with drills of various kinds.

In the full-page illustration, Fig. 1, a man is shown using a Cincinnati Electric Tool Co.'s breast drill and sinking a shothole in the rib of a heading, probably preparatory to turning a room. Saddling the real work of drilling onto the generator in the far-away power

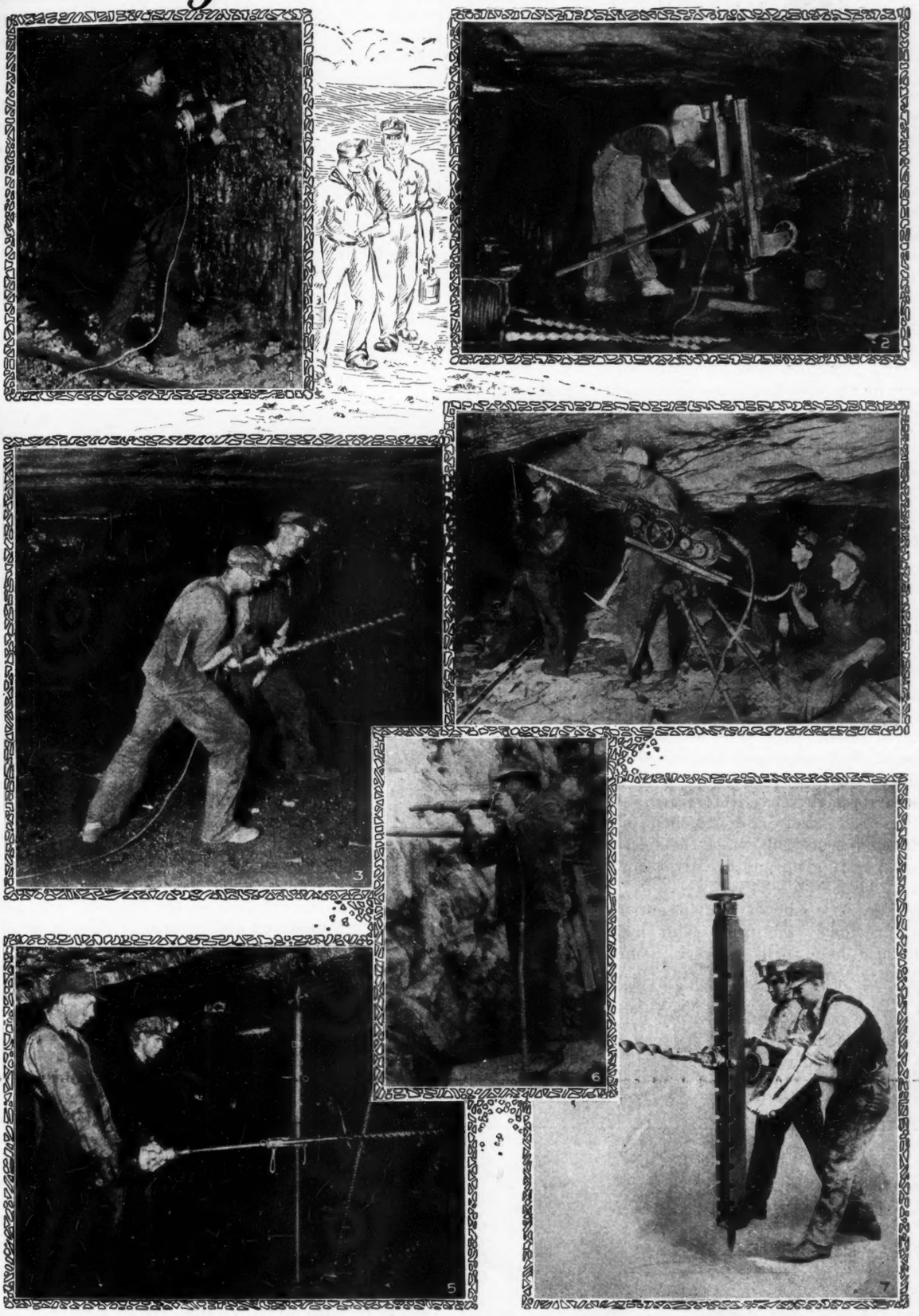
*Howard N. Eavenson and Associates, Union Arcade Building, Pittsburgh, Pa.

EXPERIENCE WITH SEVERAL TYPES OF ELECTRIC AND AIR DRILLS IN THE DRILLING OF COAL

Mining District	Seam Worked	Coal Thickness, Inches	Width of Face, Feet	Holes Per Man Per Shift	Holes Per Place	Tons Coal Per Hole	Kind of Explosive	Tons Coal Per Lb. Explosive	Kind of Power
Central Penna.	Cement	47	26	..	4	7.75	Hercules Permissible	8.1	Air from portable compressor
Central Penna.	Miller	48	26	..	4.5*	7.00	Hercules Permissible	7.3	Air from portable compressor
Connellsville	Pittsburgh	88	11	45	3	6.6	Monobel	4.4	Air and electric
Monongahela River	Pittsburgh	78	12	..	2	9.0	Monobel	5.9	Electric
Upper Monongahela	Pittsburgh	96	11	24	3	6.6	Monobel	6.6	Air
Perry Co., Ky.	No. 6	66	36	..	4	9.0	FFF Black	9.8	Electric
Perry Co., Ky.	No. 6	54	24	..	3	11.6	FFF Black	5.0	Electric
Perry Co., Ky.	No. 6	66	24	..	3	10.6	FFF Black	5.3	Electric
Western Kentucky	No. 9	54	22	..	3	5.7	FFF Black	6.2	Electric
Western Kentucky	No. 11	78	32	..	5	9.3	FF Black	6.4	Electric

* Average

Drilling Holes in Coal and Rock



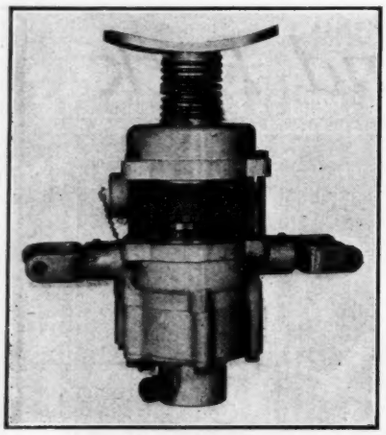


FIG. 8. ONE-MAN ELECTRIC AIR DRILL

plant is far easier than turning the cranks of a whimble drill or coal auger.

Fig. 2 shows a quite different arrangement. Here the drill motor is mounted between guides in a special post that is wedged between the floor and the roof. The drill, which is a Jeffrey Manufacturing Co. tool, is not only revolved electrically but has a power feed also. A light truck is provided for moving the machine, together with its post mounting and cable reel, about the mine. The wheeled bracket on the post facilitates movement of that member to and from the truck, as the apparatus by this means may be trundled along wheelbarrow-wise.

In Fig. 3 the motor-driven drill is so powerful that two men are required to manipulate it and force the auger into the coal. That this work is not laborious is clearly indicated. Men do not smoke when they are working hard. This drill is manufactured by the Chicago Pneumatic Tool Co.

Fig. 4 shows the Fort Wayne electric percussive drill with tripod mounting, intended for work in rock. It is shown making holes for the brushing of top but it must not be supposed that all four men are needed to operate the machine. At least two of those here shown seem to be engaged principally in bossing the job. This is one of the drills of the General Electric Co.

Fig. 5 shows a Howells Mining Drill Co.'s machine arranged with post and lead-screw feed. In this case the drill operatives merely steady the machine while its own rotation feeds it forward. A split nut engaging the lead screw and attached to the post permits quick change of bits, while the telescoping post allows of rapid setting up and greatly facilitates moving from place to place.

In Fig. 6 is shown a drill entirely different from those previously pictured. This is a light percussive pneumatic hand drill or pick hammer made by the Sullivan Machinery Co. and may be used in either coal or rock.

The Howells machine shown in Fig. 7 is intended for hand drilling in hard coal. As may be seen, it consists of a back-geared hand drive adjustably mounted on an adjustable post. A splined lead screw working in a split nut forces the auger forward into its work. Adjustable throw cranks at 180 deg. from each other make the turning easy.

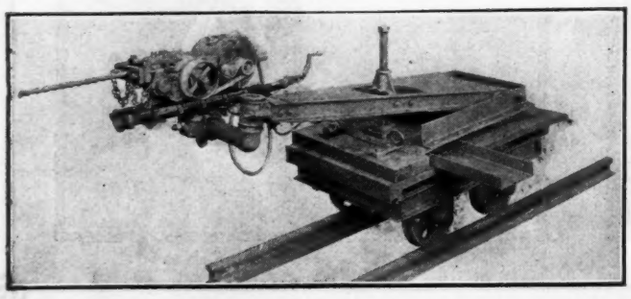


FIG. 9. DRILL MOUNTED ON BOOM OF MINE TRUCK

Fig. 8 shows a compact type of driving mechanism evidently intended for one-man operation. The spring-mounted breast strap and the D-handles upon either side are details worthy of note in this machine. This is a Pneumelectric Machine Co. drill.

Fig. 9 shows a mounting intended for operating from the room or entry track only. Here a light truck is fitted with a boom that may be raised or lowered by the action of a jackscrew. It may also be swiveled and locked in any position. From the forward end of the boom a swinging saddle arm projects, upon which the saddle that bears the drill is mounted. It will be immediately apparent that the drill may be raised, lowered, swiveled or tilted into any desired position. This is an arrangement for use with the Fort Wayne drill.

Figs. 10 and the frontispiece show hand-operated percussive air drills to work in either coal or rock.

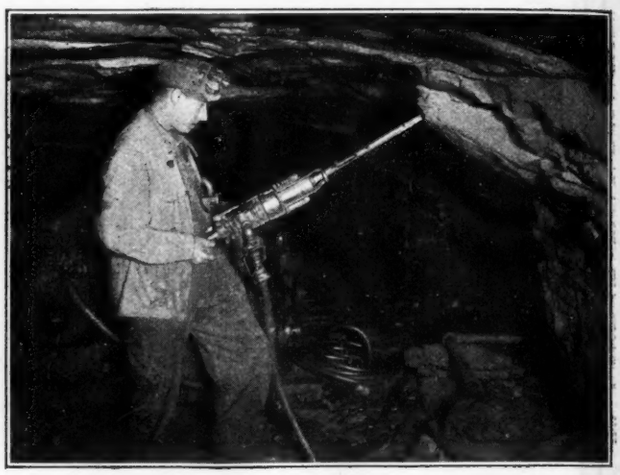


FIG. 10. DRILL DRIVEN BY ELECTRIC COMPRESSOR

In Fig. 10 the drill, a Sullivan rotator, is shown making holes preparatory to taking down top. The electric compressor from which this machine draws its air supply may be seen behind the driller. This compressor is truck-mounted and several drills may be operated from it. In the frontispiece a similar drill, a Jackhamer, made by the Ingersoll-Rand Co., is shown at work in an anthracite coal face. Although of percussive action this machine is in this case fitted with a steep-pitch helical bit. Thus as the percussive point is rotated the chips or cuttings are withdrawn from the hole. This same result may be accomplished in the case of the machine shown in Fig. 10 by exhausting the air through a hollow drill steel, thus blowing out the cuttings.

IN THE COURSE of mine-subsidence investigations, engineers of the U. S. Bureau of Mines have recently noted the effects of longwall mining on masonry buildings on the surface in the vicinity of La Salle and Spring Valley, Ill., where coal had been removed many years previously. Stone and brick buildings were found to be only slightly damaged. Quite different results were noted in an examination of a school building at Henryetta, Okla., from beneath which coal had been removed by pillar-and-room method. This building was so badly damaged by subsidence that it will have to be torn down.

Low Voltage in Mine Not Only Impedes Operation but By Wasting Electric Energy Increases Costs

Counter-Electromotive Force Alone Saves Motor from Acting as Short-Circuit—Where "Weak Power" Is Furnished Energy Is Wasted, for Motors Run at Low Efficiency and Work Is Spent in Forcing Current Through Line

By E. D. Knight*
Kayford, W. Va.

PRACTICALLY every executive who has controlled in any degree the operation of an electrified mine is familiar with the effects of reduced voltage or, as it is usually designated by machine and locomotive runners, "weak power" or "poor juice." Yet in how many instances does the mine foreman or superintendent consider this apart from the standpoint merely of annoyance and impeded operation? He knows that low voltage at the face means slower cutting and dissatisfied machine men. He knows that low voltage at the partings means smaller trips and slower hauls. He should know also that more machine and locomotive armatures are burned out when the voltage is low than when it is that, or nearly that, for which the machinery was designed. But does he realize the continuous loss in dollars and cents that operation with an excessive drop in voltage involves?

To understand clearly what that loss is the executive should have a practical, albeit rudimentary, knowledge of the manner of operation of the motors used to drive cutting machines and locomotives. Anyone who has operated a direct-current motor of fair size knows that if electric energy is applied to the brushes without first being passed through a resistance, or "starting box," the machine may burn out before it attains normal speed. He also knows that when a motor stalls and its armature ceases to rotate if the current is not soon turned off, the machine will go up in smoke. The logical conclusion, therefore, would be that the revolving armature must in some way limit the flow of current through its windings so as to reduce it to a safe value. But how?

Counter-Electromotive Force Is Set Up

The armature of a direct-current generator carries coils of insulated copper wire imbedded in slots in its surface. By causing this armature to revolve, these coils are passed in front of pole pieces, which are magnetized by the current which flows through the wire that is wound around them. In revolving these armature coils they thus pass through magnetized areas known as "fields" and in cutting them an electric current is caused to flow through them to the commutator and thence through brushes to the line by way of a switchboard and suitable control devices.

The construction of a direct-current motor is almost identical with that of a generator; in fact, either one will operate with more or less success if put in the place of the other. Obviously, then, the rotation of the armature of a direct-current motor must cause current to flow from its coils to the line. But to make this armature rotate, current is being fed from the line to it. As a result within the coils of every revolving motor armature two electric currents are flowing. These move in opposite directions and both at the same time.

The electric current passing depends upon three factors: The pressure, the volume and resistance as measured respectively in volts, amperes and ohms. The volt is the unit of pressure and the ohm the unit of resistance to this pressure. One ampere is the amount of current which one volt of pressure will force through one ohm of resistance. Every conductor of electricity has a certain resistance value. This may be expressed in ohms and depends upon the cross-section of the conductor, its length and relative conductivity and, to a lesser extent, upon its temperature. From the above Ohm's law is evolved and may be expressed as follows: $R = \frac{E}{I}$, $E = IR$, or $I = \frac{E}{R}$, when R, E and I represent the resistance, volts and amperes respectively.

Voltage Is Lowered by Opposing Voltage

The two electric currents which flow against each other in the coils of a direct-current motor armature must each have a certain voltage, and the resultant potential actually existing would, therefore, be only the difference between the two. Consequently to find the number of amperes flowing through the armature windings of a direct-current motor we must change Ohm's law to read: $I = \frac{E - e}{R}$, letting E and e equal respectively the voltage from the line and that generated in the windings.

Thus in the revolving armature the voltage generated within its conductors is responsible for limiting the flow of current through them to a safe value. On the other hand, with the armature at rest, there is nothing to prevent an excessive inflow of current. This is true also until the speed of rotation is sufficiently high to generate a current that will neutralize part of that fed in from the line. That is why "the starting box" is an essential part of the motor circuit. Electromotive force is another name for voltage, and as the generated potential is counter to the applied voltage it is called counter-electromotive force.

The watt is the unit of power. One ampere does one watt of work when being passed through one ohm of resistance by one volt of pressure. Thus the wattage of any circuit is the product of the volts multiplied by the amperes which flow therein. Motors are rated in horsepower, one horsepower being equal to 746 watts. If a motor produced a counter-electromotive force equal to that applied in driving it, naturally no current would flow. As in every case a certain amperage does flow,

*Superintendent, power and mechanical department, Cabin Creek Consolidated Coal & Coke Co.

however, the counter-electromotive force must be always lower than the line voltage.

As in a generator the output in watts is the product obtained by multiplying volts generated by amperes flowing in the circuit, so in a motor the wattage converted into useful work is the product obtained by multiplying the counter-electromotive force by the amperage. The input in watts to the same motor is the product obtained by multiplying the volts applied from the line by the amperes. The loss is therefore the difference in watts between these two results. Thus it may be seen that the nearer the value of the counter-electromotive force comes to that of the applied electromotive force, the loss will be the difference between input and output in watts and, therefore, the smaller will be the loss and the higher the efficiency of the motor. By the efficiency of a machine we do not, of course, mean its ability to do the work required of it, but to do it with a minimum of power loss. It is measured by comparing power used with power input. This efficiency, as it is directly proportional to it, is expressed in terms of counter-electromotive force. Thus if we say a 250-volt motor is 90 per cent efficient, we mean that 90:100:: the counter-electromotive force: 250. In the particular motor in question, therefore, the counter-electromotive force is 225 volts.

The higher the efficiency of a motor, the more power paid for is usefully consumed, but until we reach 50 per cent each decline in efficiency increases the capacity of a given motor, but does it at a great waste of energy, or, what is the same thing where power has either to be made or purchased at a great waste of money. The following examples will prove this point:

Let the resistance of a given motor circuit, expressed as $R = 0.3$ ohm and the electromotive force expressed as $E = 250$ volts. The counter-electromotive force we will express as e, the amperes as I, and the watts as W. Then at 90-per cent efficiency,

$$I = \frac{E - e}{R} = \frac{250 - \left(\frac{90}{100} \times 250\right)}{0.3} = \frac{250 - 225}{0.3} = 83.3 \text{ amp.}$$

Then for input watts,

$$W = E \times I = 250 \times 83.3 = 20{,}825 \text{ watts}$$

and for output watts,

$$W = e \times I = 225 \times 83.3 = 18{,}743 \text{ watts.}$$

The loss is, 20,825 — 18,743 = 2,082 watts.

Again at 50-per cent efficiency:

$$I = \frac{E - e}{R} = \frac{250 - \left(\frac{50}{100} \times 250\right)}{0.3} = \frac{250 - 125}{0.3} = 417 \text{ amp.}$$

Then for input watts,

$$W = E \times I = 250 \times 417 = 104{,}250 \text{ watts}$$

and for output watts,

$$W = e \times I = 125 \times 417 = 52{,}125 \text{ watts.}$$

The loss is, 104,250 — 52,125 = 52,125 watts.

Still again at 30-per cent efficiency:

$$I = \frac{E - e}{R} = \frac{250 - \left(\frac{30}{100} \times 250\right)}{0.3} = 583 \text{ amp.}$$

Then for input watts,

$$W = E \times I = 250 \times 583 = 145{,}750 \text{ watts}$$

and for output watts,

$$W = e \times I = 75 \times 583 = 43{,}725 \text{ watts.}$$

The loss in this case is 145,750 — 43,725 = 102,025 watts.

From these figures it may be seen that though a motor will give a greater output at low efficiencies, it can neither be constructed nor operated economically. All motors are designed for fairly high efficiencies and it is the intention that they shall have a certain load to carry while operating. If one is placed at the end of a line wherein an excessive voltage drop occurs, naturally a lower voltage is fed into its armature. Consequently because of its decreased speed a lower counter-electromotive force is generated within its coils. As it must carry a given load expressed in watts, with this lowered counter-electromotive force more amperes must flow through its windings to produce the required result. As this current value exceeds that which the windings are designed to carry, heating ensues, which often results in a burned-out armature.

Let us suppose that the demand for output watts is 18,743, as in the firse example, but that this has to be obtained with a potential of only 150 instead of 250 volts.

As $W = e \times I$; $e \times I = 18{,}743$ and $I = \frac{18{,}743}{e}$

But $I = \frac{E - e}{R} = \frac{150 - e}{0.3}$

Therefore $\frac{150 - e}{0.3} = \frac{18{,}743}{e}$

$$150e - e^2 = 18{,}743 \times 0.3 = 5{,}622.9$$
$$e^2 - 150e = -5{,}622.9$$
$$e^2 - 150e + 75^2 = -5{,}622.9 + 75^2 = 2.1$$
$$e - 75 = 1.45$$
$$e = 75 + 1.45 = 76.45$$

$$\text{Efficiency} = \frac{76.45}{150} = 51 \text{ per cent.}$$

Note that to get the work out of the motor when the voltage has fallen 100 volts it is necessary to reduce the efficiency to 51 per cent from 90, which is a conscienceless waste of power. An easy calculation will show that the current with have to rise from 83.3 amperes (which was that with 250 volts) to 245 amperes with 150 volts. With 125 volts the motor cannot be made to give the necessary power regardless of efficiency. But if it could be made to do so the results would be disastrous to the equipment, as such large currents would be used that the motors would be burned out.

Because, as stated earlier, any conductor has a fixed value of ohmic resistance, dependent upon sectional area, length and relative conductivity, it follows that the greater the load in amperes that must be forced through a given conductor, the more excessive will be the drop in voltage.

Take, for instance, 20,010 ft. of 0000 copper wire, which has a resistance of one ohm. Using the equation of Ohm's law, $E = I \times R$, for 100 amperes, $E = 100 \times 1 = 100$. Consequently with a normal line voltage of 250, a motor on the end of a circuit consisting of 20,010 ft. of 0000 wire, which requires a current of 100 amperes to operate, would be receiving a voltage of only 250 — 100 or 150 volts, the other 100 volts being wasted in forcing current to the motor. If the same motor required only 50 amperes, then as in this case $E = 50 \times 1 = 50$ and 250 — 50 = 200, current at 200 volts would be fed to the motor.

Again, if another 0000 line were tied in, doubling the capacity of the old line, there would be only one-half the resistance of 0.5 ohm. This would halve the drop in voltage in each case, so that in the first E would be

equal to 100 × 0.5, or 50, and in the second *E* would be 50 × 0.5, or 25 volts. The same result would be obtained also by moving the motor to a point half way between its original position and the source of power supply, as that would halve the length of the feeder and therefore correspondingly decrease the resistance.

A direct-current circuit consists of two parts—the positive or "hot" line and the negative, return, or "dead" line. As the opening of a switch in either conductor will result in the stoppage of all flow of current, it can be assumed that the current flows through the positive line to the motor and back through the negative line to the generator. Consequently in calculating the line drop the resistance of both lines or that of the total or complete circuit must be considered.

Too small a conducting circuit invariably results in a loss of power. In any case the multiplication of the figure for total loss in kilowatts by the price paid per kilowatt-hour will give the loss in dollars and cents for each hour's operation of such a circuit. This loss is entirely apart and distinct from that sustained through the reduced capacity and retarded operation of the mine.

Declares American Coal Miners Are Not As Careful as Foreigners

R. M. Lambie, chief of the Department of Mines of West Virginia, in an address at the meeting of the Clarksburg Mining Institute on April 20, said that the percentage of accidents in coal mines was greater among Americans than among foreigners. Pointing out that in 1921 there was one fatality for every 342 American miners, he said that among Hungarians the fatality was only one for every 645 miners. He went on to say that negroes, Italians and Spaniards were among the most careful men in avoiding accidents.

In urging miners and foremen to make themselves more efficient, he said: "From my own observation, I have seen hundreds of dollars worth of material lying idle. Piles of mine timbers are left behind in rooms, for after they get a little way from the face the miners order a fresh supply rather than carry them, and the result is that one-third of the total amount of mine timbers that are taken inside are never used. The rooms and entries are driven up and stopped, and the result is that rails, spikes, ties, fishplates, etc., are covered up with slate, and when the time comes to attack the pillars the falls have become so heavy that a new haulway is driven along the side of the former roadway and the supplies are lost for all time.

"Our present system of developing the mines in which the pillars are left standing for years is a very expensive and inefficient one, not only in cost of production but in the loss of coal. As soon as places have advanced their distance, the pillars should immediately be taken out, as the track is already laid and there are no slate falls to clean up and no places to retimber, as the timber that was set advancing is generally in good condition; in fact, a great portion of it could be recovered and used in other sections, as could the rails, ties and spikes."

Other speakers at the meeting of the institute were C. H. Hetzel, Jr., of Charleston, director of mine service stations; Robert Lilly, mine inspector, of Mount Hope; William Riggleman, of Fairmont; E. L. Griffith, mine inspector, and Hugh Smith of Clarksburg. E. P. McOlwin, institute president, introduced the speakers.

Plant Established to Reduce Timber Costs Is Operated Largely by a Single Boy

AT THE Edna No. 1 mine of the Hillman Coal & Coke Co., near Irwin, Pa., the roof requires much support and to preserve the timber from decay all large posts are treated with Protexol wood preservative. The ties also are similarly treated. One boy is engaged in this work, but he is assisted at odd times by handy men from the near-by tipple. After they are treated the timbers are raised to the level of the mine rail by the same chain-and-dog elevator which lifts the untreated timber. When posts have to be dropped in the tank, lifted out or moved from place to place the boy calls on the men at the tipple, who do the work when not otherwise employed. The men do not find that this calls for much of their time, and most of the boy's energy is expended in peeling the bark from the round timbers and in trimming the ties.

The large oak timbers are 10 in. in diameter and 11 ft. long. The boy is able to peel and treat twenty

TREATING PLANT FOR TIMBER AT EDNA NO. 1

At this mine timber is treated as part of a regular routine, not a process to be done now and again when the notion appeals. The boy in the illustration is engaged in peeling one of the large oak timbers, for which purpose a heavy draw knife is used. Several of these timbers which have already been peeled are seen in a lean-to position, directly to the right of the boy.

of this size in eight hours. He can trim sixty-five large ties of 5 x 5-in. cross-section or 100 smaller ties with a section of 3 x 5 in.

The 10-in. round timbers are immersed for 2½ hours, and the tank will hold seven timbers of this size at one time. When working on the larger material the boy, with the help of the tipple men, immerses three batches in one day, each batch comprising seven timbers. The treatment of the ties takes less time and they do not occupy as much room as round timbers. The period of submergence for these need not exceed an hour and the tank will hold from thirty to fifty ties, depending on the size. Consequently, the tank will treat more ties than the one boy employed can trim in a day.

The treatment tank is of reinforced concrete. The inside floor dimensions are 12 x 3 ft. and the depth is 20 in. The bottom slab is 8 in. thick and the sidewalls are 8 in. through on the bottom and 6 in. at the top. The sidewalls are reinforced with ½-in. worn-out steel cable, which is formed into rectangular loops lying in a horizontal plane. This cable is placed every 2 in. throughout the height of the tank. Three ¾-in. steam pipes rest on angle irons at the bottom. These keep the preservative material at the desired temperature.

A STUDY OF THE APPLICABILITY of the geophone for delimiting fires and squeeze areas has been undertaken by the U. S. Bureau of Mines at Scranton, Pa. Alan Leighton, who has made a special study of the use of the geophone in mining operations, has been detailed to make the investigation.

How to Reduce Power Costs, Increase Coal Cut and Save Steel by Handling Bits Judiciously

Methods Adopted in Supply of Cutter Bits—In Shafts Enough Bits to Run Three Days Without Sharpening May Be Needed—To Each Machine Its Own Bits—High-Carbon Steel Better Than Low-Carbon or Alloy Steel

BY CHARLES B. OFFICER*
Chicago, Ill.

PRIOR to the war many coal operators, realizing the advantage—in fact, the necessity—of having better cutter bits for their chain mining machines, had conducted many experiments and tests at their mines to determine how the greatest cutting efficiency could be attained. Several mines had progressed far enough with their experiments to establish fixed methods or rules for handling these bits. Other advanced ideas and theories were being considered with a view to cutting down costs for the blacksmithing and renewal of bits.

During the war the urgent demand for greater coal production, the scarcity of labor, the difficulty of obtaining proper material and many other items completely absorbed the mine operator's attention. In the rush of events many of the rules and methods which had been established for the mining of coal in an economical manner had to be abandoned. The shape and quality of the cutter bit at many mines deteriorated materially. Within the last year or so, in an endeavor to reduce operating expenses, many mines have reconsidered the results of former experiments on cutter bits and have tried to curtail their costs further by giving the whole subject careful consideration.

The cutter bit is the actual vital functioning part of any mining machine. It is the point of final application of power from the mining machine to the cutting of coal. The condition of the bits determines to a great extent the amount of coal which a machine can cut per shift. There also is a relation between the character of the bits and the amount of power consumed in cutting. The cost of mining-machine repairs is directly dependent upon the form, quality and quantity of cutter bits supplied to the mining machine.

MINER WAITED TILL HIS PICKS WERE SHARPENED

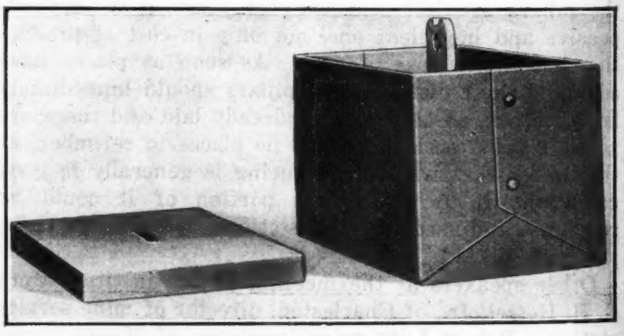
In the days when hand-mining methods were prevalent no one would consider sending a miner underground with hand picks improperly sharpened or hardened. Every miner, before going underground, would examine his picks carefully, as he knew from experience that the amount of coal which he could produce depended largely upon the condition of his tools. The cutter bits on a chain machine bear the same relation to the quantity of coal that a mining machine can cut as the old hand picks did to the quantity of coal which a hand miner could produce. These cutter bits should be given the same careful attention that the hand miner formerly gave to his picks, if the maximum efficiency and economy is to be obtained from chain mining machines.

The subject of cutter bits can be divided up into three general headings as follows: First, the handling of sharpened cutter bits from the blacksmith shop to the mining machines and the return of dull bits from the machine to the blacksmith shop. Second, the proper shaping or sharpening of the dull bit. Third, the proper selection of material for the particular conditions encountered in each mine.

When chain mining machines were first being installed it was the custom at many places for the machine runner and helper to carry the sharpened bits in with them at the start of a shift's work. The dull bits were returned by them at the end of the shift. If the cutting proved harder than anticipated, and the supply of sharpened bits accordingly was depleted, the helper was required to make a trip to the blacksmith shop for others to replace them. Much time and tonnage were lost by this system of handling the bits in and out of the mine. With the advent of more machines underground, improvements in the methods of supplying the bits into, and out of, the mine were developed, so that the chain machines would be provided with plenty of sharpened bits at all times and there would be no loss in the tonnage cut due to the waiting for a new supply of picks.

BITS CANNOT UPSET INTO BOTTOM OF CAR

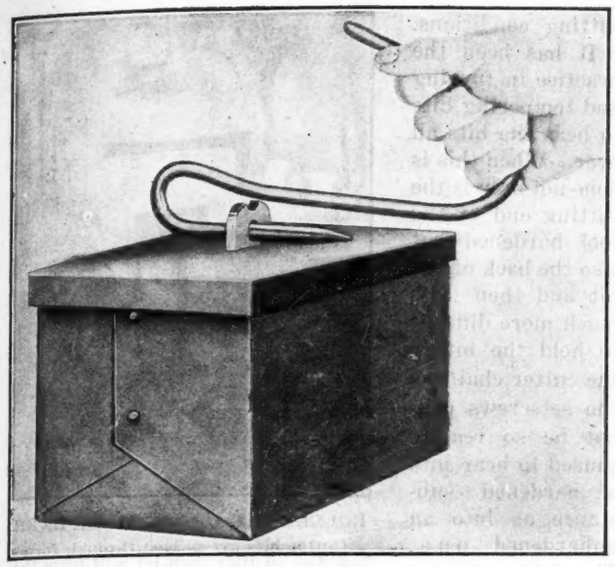
Many different systems are employed to obtain the desired results but experiments with different methods of transporting the bits have led to the general conclusion that some form of metal container is most suitable. Several types are in use. The bit box shown below, made by the Mine Safety Appliances Co., is well designed. Such a box will hold approximately 50 bits, which consequently will replace between one and two complete mining-machine sets, depending, of course, on the length and type of cutter bar used. In order to have the transportation of the bit boxes on the pit cars as safe as possible it is better to use a box so con-



BOX FOR THE BITS OF CUTTING MACHINES

If the bits are put in a lettered box for a specific machine bearing the same letter, there is less likelihood of a machine being inadequately rationed and track can be kept of the number of bits used.

*Sullivan Machinery Co.



BIT BOX FILLED AND CLOSED FOR SHIPMENT

An upright standard in the center of the box, over which the slotted cover is passed, is provided with a hole through which a double hook handle is slid, holding the box lid tight.

structed that it can be hooked onto the end of the pit car rather than put in the bottom of an empty or dropped in among the coal on a car that is loaded.

At slope or drift mines, by availing oneself of the movement of the pit cars bits may be carried in and out of the workings at any time during the shift. In shaft mines, where it is desirable to maintain production up to the maximum capacity of the cages, more systematic methods have to be employed. Some shaft mines have found it economical to have such a large quantity of bits on hand that they can keep a full shift's supply of bits at the machine and an equal number at the blacksmith shop being sharpened for the next day's operation. In this way the sharpened and dull bits can be lowered and hoisted at the same time as the other supplies that are needed in the mine. Where such a system is used the total quantity of bits on hand should be approximately two and one-half to three times the number of bits used by all machines in the mine during a shift.

In order to facilitate an equal and just distribution of cutter bits to the various mining machines the set of bit boxes for each mining machine should be stamped with a number corresponding to the number given the chain machine itself. Letters such as A, B, C, etc., on the boxes themselves will serve as a distinguishing mark for each individual box. When the containers are stamped with a number corresponding to that given a mining machine the bottom men can readily and correctly assort the boxes and place them in those particular mine cars that are going to the various territories where the mining machines are working to which the bits have been apportioned. At some agreed place in the territory of each machine the bit boxes should be unloaded from the pit cars so that the machine man may know exactly where he can always find a supply of the new bits.

Another advantage of having the containers separately numbered is that records thus can be obtained of the quantity of bits used by each machine per shift. To do this a count must be made and listed, at the blacksmith shop, of the number of sharpened bits put in each box and the number of dull bits returned. Where such records are kept and the tonnage output and repair cost of each mining machine are compared with the number of bits used the mine management has information which is quite enlightening. Allowance must always be made, however, for the variation in cutting conditions which the different sections of the mine present.

When chain mining machines were first installed, comparatively few bits were used, because each machine used only a few bits, because there were few machines at any one mine, and also because mines were not as systematically laid out in regard to cutting territories as at present, and the chain machines did not then produce the tonnage per machine that they do now. The blacksmiths were then able to sharpen the bits by hand and generally produced well-shaped and well-tempered bits. As time went on, and more machines were introduced, there was an increase in the number of bits which had to be sharpened daily. This increase did not permit the smith to give enough time to each bit to insure its proper shaping so long as the work had to be laboriously performed by hand.

Various types of power hammers were then introduced so as to increase the number of bits resharpened per shift by each blacksmith. These hammers did not have exact forming dies for shaping the bits and produced a properly shaped bit only when the blacksmith took the necessary, and by no means brief, time to hammer each bit into shape, and under the best conditions there was no assurance that two bits would be turned out identical in shape.

Within the last year a cutter-bit sharpening machine has been developed which insures that each bit after being sharpened will have the correct outline. This machine forges these cutter bits by passing the bits through forming dies, thus making it certain that each bit will have the proper shape and be identical with every other bit so sharpened.

A bit should have correctly proportioned clearance, side clearance and back-slope angles. The correct angles and an analysis of the reasons for each can be found in the Jan. 12 issue of *Coal Age*.*

Economy of Having Bits Properly Shaped

When cutter bits are of proper shape a larger tonnage is cut and the power consumption and repair costs are decreased. Thus equipped many mines have been able to decrease the power consumption of their mining machines from 20 to 25 per cent. Other mines, where the coal to be cut is fairly soft, have found that not only was there a reduction in the power consumed but also that with a set of these properly sharpened bits more places could be cut before the bits had to be renewed than could be cut with their old-type bit.

This saving in the time required to set bits has resulted in greater tonnage output not only in the beds that are easily cut but also in those that are of greater hardness. Although no definite figures have been obtained as to the saving in repair expenses, as these bit-sharpening machines have not been installed long enough to have this saving in renewals accurately determined, it is believed from the results which have been obtained so far that there will be a reduction of between 10 and 15 per cent in this item.

The third consideration—namely, the selection of the bit material and the proper heating for sharpening and

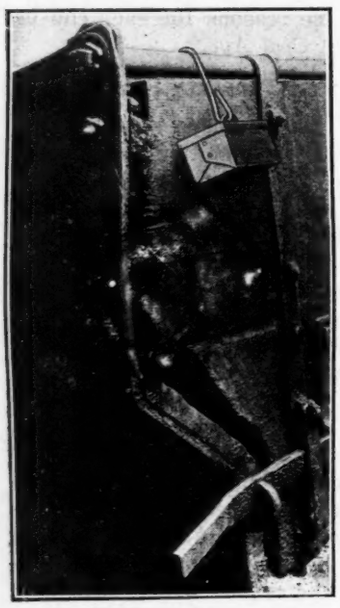
*Page 47.

hardening—is closely allied to the proper shaping of the bit. Various grades of steel have been tried at different times for cutter-bit steel. The cheaper steels, having a very low carbon content, have proved unsatisfactory. High-carbon steel of medium price has given good results. Expensive alloy steel has been tried and has been found not to be as satisfactory as high-carbon steel.

Steel of low carbon content (from 0.10 to 0.30 per cent carbon) cannot be tempered so as to produce a satisfactory cutting tool. Such steel quickly dulls and even when properly shaped the bit requires constant resetting. This steel readily bends upon striking any hard obstruction in the coal, and, because of the low carbon content, it cannot be hardened so as to retain its cutting edge.

The high-priced alloy steels, when properly shaped and tempered, give a bit that would make a clean, even kerf in the coal, if no rash, sulphur balls, etc., were encountered. We are always hoping for such conditions, but never find them. The alloy steel on striking impurities is readily broken. Alloy-steel bits are more brittle than high-carbon steel and for this reason break more readily than the high-carbon bits when they strike impurities in the coal. The loss of material through these broken bits and the high price paid for this material more than offset all the other advantages which this steel has shown in cutting other materials.

From actual experience it would appear that steel around 0.70 per cent carbon and 0.25 to 0.35 per cent manganese will give the most economical results. Some mines have obtained better results by using a steel of slightly higher carbon content and others have obtained greater efficiency by using one of high carbon percentage with a small percentage of chrome and nickel. The disadvantage of having too high a carbon content in the steel is in the fact that such a steel is easily spoiled in the blacksmith shop by overheating and that unsatisfactory results are obtained from these bits underground. Steels having a carbon content around 0.70 per cent have a sufficiently wide range of temperatures at which they can be forged and hardened so that with ordinary care and attention they are not likely to be burned.

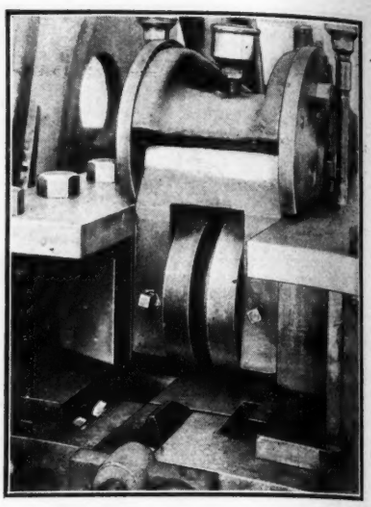


BOX HUNG ON HIND RAIL OF CAR

Bits should not be laid in an uncovered box in the bottom of the coal wagon, for when thus promiscuously handled they may be lost only to turn up unexpectedly and unwelcome in the jaws of a crusher.

The proper hardness to give the bits depends largely on local conditions. A good rule is to have the bits so tempered that some come back bent while others are broken. Those that are bent are not hardened sufficiently, while those that break are too hard. If about an equal number of the dulled bits are bent and broken it indicates that the steel is being tempered on the average about right for that particular set of cutting conditions.

It has been the practice in forging and tempering bits to heat the bits all over. When this is done not only is the cutting end of the tool hardened but also the back of the bit and then it is much more difficult to hold the bit in the cutter chain, as the setscrews cannot be so readily caused to bear into a hardened substance as into an unhardened one. The bit can be shaped and hardened just as easily when the end alone is heated as when the whole bit is submitted to the heat of the fire. In places where the bits are hardened all over the repairs on the cutter chains and cutter-chain setscrews are found to be higher.



ROLLER DIE OF BIT SHARPENER

Cutter bits are passed through forming dies so that each bit will have the exact shape desired.

How To Reduce Undercutting Costs

As a result of these studies the following recommendations are made to coal-mine managers:

(1) Provide adequate containers for carrying the bits and establish a proper system of transportation and recording, so as to keep track of the number of bits used by the different machines under different conditions.

(2) Equip mine blacksmith shops with apparatus to resharpen the bits to these specifications, quickly and at low cost and thus obtain the advantages of properly shaped and absolutely uniform bits.

(3) Purchase the proper steel for cutter bits and see that the bits are intelligently and carefully heated and tempered for the particular conditions prevailing in each mine. Lay special emphasis on the importance of exercising care to avoid the burning of steel.

If these relatively simple requirements are constantly observed, large economies will be effected in labor, in power consumption and in mining-machine repairs, with a corresponding increase in the rate of production.

In the physico-chemical study of sulphur in coke being made by A. R. Powell, physical organic chemist of the U. S. Bureau of Mines at Pittsburgh, Pa., experiments have been conducted on the study of the decomposition of calcium sulphide. It was found that, working with boiling water at 100 deg., calcium sulphide is hydrolized very slowly, the rate being increased by the addition of magnesium oxide. Small-scale laboratory tests will be made on coke containing fairly pure calcium sulphide to discover if it is feasible for desulphurizing coke.

In the study of the distillation of Freeport coal being made at the Pittsburgh Experiment Station of the U. S. Bureau of Mines, duplicate samples of the bone and cannel constituents of the Freeport seam have been distilled at low temperature in 12-lb. lots. A sample of the bottom section of the clean coal also was distilled. From a comparison of the yields it would seem that the bone and cannel constituents of this seam should be of too great value to be treated as refuse.

Census Figures Prove That Output Per Man Advances With Increase in Use of Mining Machinery

Nearly 50,000 Electric Motors Are Used at Coal Mines—From Two to Four Horsepower, Roughly Speaking, Is Installed per Employee and the Output per Horsepower Is in General Between 200 and 350 Tons

By Frank H. Kneeland*
New York City

SELDOM can those engaged in any large industry visualize its dimensions, either in detail or in their entirety. Few men unaided ever gain a clear view of the coal industry, perceive its trends, sense accurately its tendencies or gage and analyze their portent. Nevertheless, we, who make coal production a business, sometimes gain astonishing glimpses of our calling from purely outside sources.

Figures presented by the report of the 14th Census of Mines and Quarries of the United States, covering the year 1919, are of unusual interest. Some of the more salient data, so far as those interested in power and its consumption at the mines are concerned, are set forth in the accompanying table. Though the figures thus tabulated show much that is of interest to the mining man, they fail to enumerate certain facts that he would gladly know. Thus the total horsepower of the prime movers employed in the industry is shown by states, as is also the number and horsepower of the motors operated on purchased energy, as well as the number and rated capacity of those operated from current generated. But the rating and number of the generating units installed is not set forth; neither is the number of horsepower- or kilowatt-hours consumed.

Fifteen Thousand Prime Movers at Mines

As may be seen in the accompanying table, the prime movers of the industry include 13,507 steam engines, 360 steam turbines, 1,323 internal-combustion engines and 3 waterwheels. The average rated capacity of the steam engines is slightly over 130 hp., that of the steam turbines 687 hp. each, of the internal-combustion engines 17.4 hp., and of the waterwheels 150 hp. Generation of energy produced at the mine plants required the burning as fuel of 9,573,978 short tons of anthracite and 11,228,270 net tons of bituminous coal; also 24,603 bbl. (about 948,120 gal.) of fuel oil and gasoline; 976,820,000 cu.ft. of natural gas, 564 cords of wood and 25 tons of coke. Figures on the coal burned at the mines of the State of Alabama, however, include 14,254 tons of coke. The coal industry also employed 47,829 motors averaging 37 hp. each.

In the accompanying table, columns 1 to 21 inclusive are taken direct from the census report referred to. Column 22 shows the production of the various states in net tons. These figures are those of the U. S. Geological Survey. The figures in succeeding columns except No. 30 are all calculated from those previously presented. Thus column 23, showing the tons of coal produced annually per horsepower installed, is obtained by dividing the tons of production shown in column 22 by the aggregate horsepower as shown in column 3. The fractions given in the footnote of the table show how the results set forth were secured. Thus in the case just cited the fraction $\frac{22}{3}$ indicates that the figures in this column are the quotients obtained by using the figures of column 22 as dividends and those of column 3 as divisors.

Column 24 shows the horsepower installed per employee. These results were obtained by dividing the figures of column 3 by those of column 2. Column 25 shows the tons produced per man employed, the results set forth being obtained by dividing the productions of the various states, column 22, by the number of men there employed, column 2. Column 26 shows the percentage of installed motor horsepower operated on purchased current, and column 27 shows the apparent percentage of electrification. This is obtained by dividing the figures of column 16 by those of column 3. Concerning these results more will be said later.

Columns 28 and 29 are mutually complementary and show respectively the percentage of power used that was generated by the user and the percentage that was purchased. It is interesting to note that while the apparent percentage of electrification for the whole country is 58.3, the energy generated and the energy purchased are to the whole energy used 71 per cent and 29 per cent respectively.

Columns 23, 24 and 25 are highly interesting. From

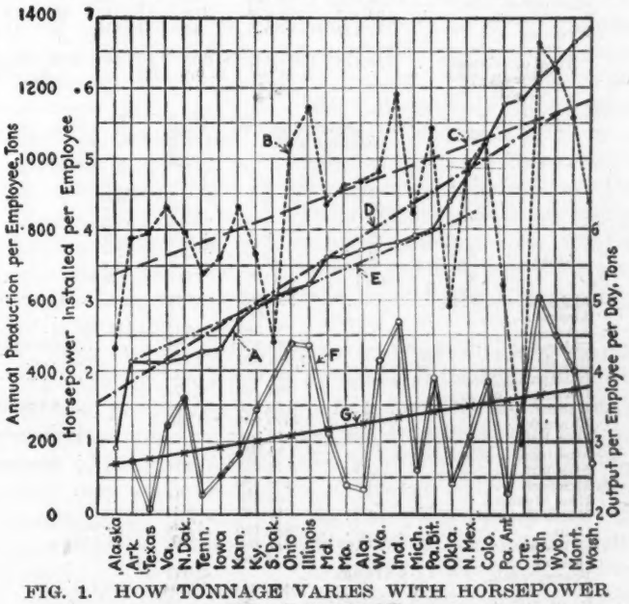


FIG. 1. HOW TONNAGE VARIES WITH HORSEPOWER PER EMPLOYEE

States are arranged in order of horsepower installed per mine worker, the graph *A* showing this relation. The yearly production per man is shown by graph *B*, the profundities for Pennsylvania anthracite and Oregon being the natural outcome of difficult mining conditions. *C* and *D* are straight lines representing average annual production per man employed and average power installed per employee respectively. A similar average line, *E*, has been drawn for average power installed per employee in the level coal bed regions. *F* shows output per man per day and *G* is a line averaging this graph.

*Associate editor, *Coal Age*.

the first, or column 23, it will be seen that the amount of coal produced per horsepower installed varies from a minimum of 34 tons in Oregon to a maximum of 498 tons in Alaska. Both of these figures, however, probably are abnormal. Most of the figures representing production per horsepower given in this table lie between 200 and 350 tons. Few of the larger coal-producing states lie beyond this range in either direction.

Columns 24 and 25, showing the horsepower installed and the tons produced per employee respectively, may advantageously be considered together. We may well inquire if any relation exists between these two quantities. The interconnection between them probably is brought out more forcibly in Fig. 1 than in the table. In this figure, beginning with Alaska, which is obviously both unimportant and underpowered, most of the work there done being in the nature of exploration, the states are arranged from left to right in the order of their respective horsepower installed per employee. These quantities have been plotted as ordinates, so that the solid-line curve *A* can be drawn. This curve immediately reveals some striking facts.

Most of the coal-producing states have installed less than 4 hp. per employee. With the exceptions of Kentucky and Virginia, no state producing 10,000,000 tons or more has installed less than 3 hp. per employee. With one exception also all fields wherein the amount of power per employee exceeds 4 hp. lie in the West, in what might be termed the mountain coal fields. This

COMPARISONS BETWEEN U. S. CENSUS FIGURES ON POWER AND U. S. GEOLOGICAL SURVEY FIGURES ON PRODUCTION PER EMPLOYEE

State	Persons Engaged in The Industry	Aggregate Amount Of Power Used H.P.	Steam Engines		Steam Turbines		Internal Combustion Engines		Total Horsepower Of Prime Movers Installed	Amount of Power Purchased Horsepower	Motors Operated On Generated Current		Motors Operated On Purchased Power		Total All Horsepower Motors Operated
			Number	Horsepower	Number	Horsepower	Number	Horsepower			Number	Horsepower	Number	Horsepower	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
Alabama	26,162	97,039	415	56,802	4	1,367	30	774	59,017	38,022	671	25,311	868	38,022	63,333
Alaska	164	152	8	129	...	...	6	23	152	...	1	10	...	...	10
Arkansas	2,862	6,137	76	5,190	1	100	11	752	6,042	95	25	783	3	95	878
Colorado	12,017	63,016	274	30,327	2	1,050	4	84	31,461	31,555	253	10,481	785	31,455	41,936
Illinois	77,825	247,142	1,609	186,926	36	17,725	88	1,126	205,777	41,365	3,165	95,916	1,070	41,365	137,281
Indiana	25,911	99,585	687	78,912	15	1,902	64	344	81,158	18,427	817	41,890	407	18,427	60,317
Iowa	11,239	26,123	214	13,389	4	1,690	85	806	15,885	10,238	67	4,119	288	10,233	14,352
Kansas	8,622	23,434	353	18,978	...	...	36	356	19,334	4,100	37	1,041	233	4,100	5,141
Kentucky	43,347	126,804	442	57,005	43	23,786	64	462	81,253	45,551	1,925	53,222	1,143	45,551	98,773
Maryland	5,180	18,660	172	12,302	1	750	24	516	14,018	4,642	94	3,872	139	4,642	8,514
Michigan	1,744	6,884	49	6,114	1	75	...	...	6,189	695	179	5,285	10	695	5,980
Missouri	7,852	28,385	362	24,394	5	335	92	706	25,435	2,950	130	3,123	140	2,950	6,073
Montana	4,056	27,077	60	14,679	13	4,350	11	103	19,132	7,945	145	5,239	185	7,945	13,184
New Mexico	3,774	18,063	15	2,745	11	10,548	2	40	13,333	4,730	250	5,104	125	4,730	9,834
North Dakota	939	2,037	28	1,530	...	...	38	253	1,783	254	9	100	24	254	354
Ohio	43,433	136,145	650	79,949	4	3,275	120	1,354	84,578	51,567	1,498	38,145	1,647	51,447	89,592
Oklahoma	8,296	36,483	277	29,187	4	700	31	253	30,140	6,343	142	5,159	207	6,343	11,502
Oregon	67	393	6	375	...	...	...	...	375	18	15	355	3	18	373
Pennsylvania	A154,882	899,783	5,298	730,141	45	50,665	73	1,284	782,090	117,693	3,801	185,723	1,881	117,693	303,416
	B165,044	658,963	2,194	348,402	100	86,273	319	10,015	444,690	214,273	8,045	278,780	5,953	214,208	492,988
South Dakota	16	49	1	35	...	...	3	14	49	...	...	...	...	...	...
Tennessee	10,170	22,946	146	19,093	2	928	49	722	20,743	2,203	263	10,520	73	2,203	12,723
Texas	2,862	6,137	76	5,190	1	100	11	752	6,042	95	25	783	3	95	878
Utah	3,926	24,029	40	7,755	4	2,085	...	...	9,840	14,189	143	7,764	276	14,189	21,953
Virginia	11,940	41,630	91	9,228	1	600	19	188	10,016	31,614	256	9,775	944	31,614	41,389
Washington	4,654	32,190	98	19,006	7	1,781	5	70	20,857	11,333	315	10,619	196	11,333	21,952
West Virginia	93,767	355,479	778	123,212	40	18,969	136	2,059	144,240	211,239	2,500	87,256	6,008	211,182	298,438
Wyoming	7,427	47,075	88	14,858	16	18,240	2	45	33,135	13,940	92	3,966	355	13,940	17,906
Total or average	738,178	3,051,840	14,507 av. hp. 130½	1,895,845	360 av. hp. 687	247,294	1,323 av. hp. 17.4	23,092	2,166,764	885,076	24,863	894,341	22,966	884,729	1,779,070

State	Coal Consumed as Fuel in Short Tons: Anthracite	Bituminous	Liquid Fuel (Fuel Oil, Gasoline, etc.) Consumed Barrels	Gas Used as Fuel 1,000 cu.ft.	Remarks	Tons of Coal Produced**	Tons Produced Per Horsepower Used	Horsepower Installed Per Employee	Tons Produced Per Employee	Proportion of Motor Horsepower Operated on purchased energy	Apparent Percentage of electrification	Percent of Power Used generated by User	Per cent of Power Purchased	Output Per Man Per Day, Tons
	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)	(25)	(26)	(27)	(28)	(29)	(30)
Alabama	...	524,069*	1,140	...	*Inc. coke 14,254	19,184,962	197	3.71	733	60.0	65.2	60.7	39.3	2.42
Alaska	...	2,688	5	...	...	75,606	498	.93	461	...	6.6	100.0	...	...
Arkansas	...	53,867	1,015	110,913	...	2,227,369	364	2.14	778	10.8	14.3	98.5	1.5	2.76
Colorado	...	286,909†	34	...	†coke 25 tons	12,407,571	197	5.25	1,060	75.0	66.4	50.0	50.0	3.88
Illinois	...	1,946,807	2,200	...	...	89,291,105	361	3.18	1,147	22.6	55.6	83.2	16.8	4.41
Indiana	...	705,031	1,037	...	...	30,678,634	304	3.84	1,185	30.6	60.5	81.5	18.5	4.72
Iowa	...	184,205	1,222	...	...	8,192,195	314	2.32	719	76.3	55.0	60.7	39.3	2.59
Kansas	...	170,666	362	...	60 cords wood	7,561,947	322	2.72	878	80.0	22.0	82.5	17.5	2.89
Kentucky	...	679,943	1,805	...	...	31,612,617	250	2.92	730	46.2	78.0	64.1	35.9	3.49
Maryland	2	46,262	....	...	3 water wheels, 450 hp.	4,497,297	240	3.6	867	54.5	45.6	75.2	24.8	3.13
Michigan	...	83,824	...	...	...	1,464,818	212	3.94	840	1.2	86.8	90.0	10.0	2.65
Missouri	...	143,433	1,014	...	400 cords wood	5,667,730	200	3.61	722	48.6	21.4	89.6	10.4	2.44
Montana	...	163,456	113	...	...	4,532,505	174	6.67	1,115	60.3	48.7	70.7	29.3	4.05
New Mexico	...	45,834	14	...	...	4,023,239	222	4.78	992	48.1	54.4	73.8	26.2	3.07
North Dakota	...	16,437	451	...	...	719,733	358	2.17	766	71.7	17.4	87.5	12.5	3.63
Ohio	...	675,165	1,516	2,468	...	45,812,943	336	3.14	1,057	57.3	65.9	62.2	37.8	4.41
Oklahoma	...	177,267	507	154,570	...	4,813,447	132	4.4	581	55.0	31.5	82.6	17.4	2.45
Oregon	...	4,869	...	...	...	13,328	34	5.86	198	4.8	95.0	95.4	4.6	...
Pennsylvania	A 9,573,985	...	2,052	...	...	A 98,826,084	110	5.8	640	38.8	33.7	87.0	13.0	2.14
	B ...	3,304,925	5,204	310,914	...	B 178,550,741	271	3.99	1,080	43.5	75.0	67.4	32.6	3.96
South Dakota	...	28	15	...	...	7,942	162	3.06	481	...	...	100.0	...	...
Tennessee	...	141,222	540	...	104 cords wood	6,831,048	298	2.26	672	17.3	55.5	90.4	9.6	2.25
Texas	...	53,867	1,015	110,913	...	2,261,135	369	2.14	790	10.8	14.3	98.5	1.5	2.03
Utah	...	82,907	....	...	...	5,136,825	214	6.14	1,318	64.6	91.2	41.0	59.0	5.03
Virginia	...	113,881	362	...	...	10,289,808	246	2.14	860	76.5	99.2	24.0	76.0	3.26
Washington	...	173,052	126	...	...	4,082,212	127	6.9	877	51.7	68.2	64.8	35.2	2.74
West Virginia	...	1,124,614	2,763	287,042	...	89,935,839	252	3.79	958	70.8	84.0	40.6	59.4	4.18
Wyoming	...	323,042	91	...	...	9,438,688	200	6.34	1,238	77.9	38.0	70.4	29.6	4.48
Total or average	9,573,987	11,228,270	24,603 984,120 gal.	976,820	...	678,137,368	225	4.13	917	49.6	58.3	71.0	29.0	3.322

**U. S. Geological Survey's tonnage report. In this table 23 = ½; 24 = ¼; 25 = ½; 26 = ⅛; 27 = ½; 28 = ½ and 29 = ½.

solitary exception is the anthracite region of Pennsylvania. It will be at once admitted, however, that this region, if not actually mountainous, is at least rugged both above and below ground, and no doubt many of the coal regions of the West are comparable physically to it. It is probable, furthermore, that the pitch of the beds determines the needed horsepower far more than does the contour of the surface, although both are doubtless important factors.

Now, by setting off the yearly production per employee in each state to a suitable scale as an ordinate and joining the points thus found, we get the dotted line or curve *B* of Fig. 1. This graph is highly erratic. Strangely enough its maximum and minimum are adjacent points on the curve and represent the yearly man-output of states comparatively near together. Thus Oregon had the lowest production per employee of any state in the Union, and its neighbor, Utah, had the highest, the exact tonnage figures being 198 and 1,318 respectively. Apparently some sinister influence was at work in Oregon during the year 1919.

Though curve *B* presents a ragged outline, it is interesting to note the similarity of the yearly outputs per man in states or in fields subjected to approximately the same physical and market conditions. Thus, note the similarity of output per employee in Virginia, Maryland and West Virginia. This resemblance is striking also in the cases of Indiana and Illinois, with which Ohio and the Pennsylvania bituminous region may be compared. It is probable, therefore, that if the states in this list were arranged according to their geographical locations instead of either alphabetically, as in the table, or according to their installed horsepower per employee, as in this figure, a much smoother curve would result.

Now, if we disregard the anthracite region of Pennsylvania, which, as everyone knows, is subject to conditions and problems peculiar to itself, and also neglect Oregon, where both mines and output are small and where apparently also either operating or market conditions or both were peculiar, we may draw a curve representing the average annual production per employee. This is shown as curve *C*, which, as here drawn, is a straight line. Similarly a straight-line curve or graph *D*, may be drawn showing the average power installed per employee.

Yearly Output Rises with Installed Power

The important thing about curve *C* is not its actual height above the base line at any point or points but the fact that it has the same general slope—that is, inclines in the same direction—as curve *D*. This consequently shows that the average yearly production per employee in a general way increases with an increase of power installed per employee. Although this increase is not proportional to the power installed, yet notice how nearly the average production per employee, as represented by curve *C*, parallels the average horsepower installed per employee for the bituminous regions between Texas on the west and Pennsylvania on the east, as shown by curve *E*. This is the region of the country where the coal beds lie flat or pitch only moderately. The similarity of these two curves is remarkable and, I believe, significant.

This belief is much strengthened by the fact that if we consider the West or mountain coal field as a seperate region and construct for it average-power and out-put-per-employee curves as before, these also will be found to be nearly parallel. That this will be the case will be immediately apparent from a study of the figure, bearing in mind that the Pennsylvania anthracite field and Oregon are neglected in both curves.

Figures covering the coal output per man per day recently have been published by the U. S. Geological Survey. These are shown in column 30 of the table. In Fig. 1 these outputs have been plotted for the various states, the ordinate scale or that of tons per employee per day appearing along the right margin. It will be noted that in both figure and table the outputs for Alaska, South Dakota and Oregon are missing.

Joining the points showing the outputs per man per day for the various states and fields shown we get the jagged graph *F*. The average output per man, or the graph *G*, may then be drawn from inspection. This while by no means parallel with either *C*, *D* or *E*, has a similar slope, showing that in general the output per employee per day increases with an increase in the power installed just as does annual production.

Half the Motors Run on Purchased Power

The figures set forth in column 26 of the table show the ratio existing between the horsepower of motors operated on purchased energy and the horsepower of motors operated on current generated by the user. For the country as a whole, just about one-half—that is, 49.6 per cent—of the electric motors operated are run on purchased power.

When we come to the figures of column 27 we reach a point where caution must be observed. It is an old saying that figures never lie. It has been my experience, however, that while most of them are honest, like most human beings, some of them are like some people and will bear watching. While they may not exactly prevaricate, they apparently have no particular aversion to practicing deception. In the case of the data here presented, unless care is exercised, false conclusions may be drawn.

Thus it would be easy to assume that the ratio of the total horsepower of all motors operated to the aggregate amount of power used would represent the true percentage of mine electrification. This conclusion, however, is by no means justified, as the ratio of rated installed capacity of the motors operated from mine generating plants to the rated capacity of these plants is not known. While some engineers advocate that the connected load on a generating station should not appreciably exceed the generating capacity, some mining companies have found it advantageous to make the connected load several times the rated generating capacity of their plants.

Thus one well-known firm in West Virginia operating a fairly large group of mines electrically from one central generating station has found it both feasible and advantageous to make the connected load 330 per cent of the generating capacity. Such instances as this, and they probably are by no means either isolated or exceptional, vitiate the figures presented under the heading "percentage of electrification" to an appreciable extent. The figures of column 27, therefore, are here presented and should be accepted with due reservation. They represent rather an interesting apparent indication than a real value.

Now, of course, the installed horsepower of either prime movers, or motors, or generators, whether in the aggregate or per ton of coal produced, is no criterion by which to measure the coal industry. The real yard-

stick both of electrification and of production is the horsepower-hour or kilowatt-hour. If we knew the ratio of the electrical horsepower-hours consumed in the coal industry to the total horsepower-hours consumed, we would have a true measure of the industry's electrification. It would be far more interesting and profitable to know the number of horsepower-hours required for the production of a ton of coal in the various states than to know the tons of production per installed horsepower as here set forth; more interesting to know the number of horsepower-hours expended yearly or daily per employee than the installed horsepower per employee. Unfortunately, however, few coal producers measure all of the energy they consume in these or any other units, and the Bureau of the Census had recourse only to the installed rated horsepower, which could be obtained both easily and accurately.

Thus, while, as stated at the beginning, the figures presented in the accompanying table and illustration leave much to be desired, they nevertheless furnish a means of drawing some interesting and valuable conclusions. The curves of Fig. 1, while possibly illogical in foundation and probably not absolutely accurate in detail, are nevertheless unmistakable in trend and portent.

Canadian, Utah and Idaho Fuels Give Most Heat of Those Entering Spokane Market

ANALYSES made by the staff of the School of Mines and Geology of the State College of Washington and exhibited by them at the Northwest Mining Convention, held at Spokane, Wash., Feb. 28 to March 5, 1921, show that some of the Canadian coals from the Rocky Mountain regions are leaders in calorific power, the best quoted, by a narrow and uncertain margin, being Green Hill mine-run, which ran as delivered, with 1 per cent of moisture, 14,635 B.t.u.

The coals Nos. 1 to 42 were furnished by Spokane fuel dealers and represent coals marketed in Spokane. Mine owners furnished samples Nos. 43 to 47. Analyses were made on (A) air-dried samples and (B) moisture-free samples and heat determinations were made by the Emerson bomb calorimeter. All the coals are bituminous except the "Canadian anthracite" from Bankhead that United States practice would denominate semi-anthracite, the volatile matter running 9.2 per cent.

Name	Origin		Moisture	Fixed Carbon	Volatile Matter	Ash	B.t.u.	No.
UTAH COALS								
Aberdeen	Kenilworth	A	2.2	45.6	46.4	5.8	13,259	31
		B	....	46.7	47.4	5.9	13,558	..
Black Hawk, egg	Black Hawk	A	3.70	47.32	44.98	4.0	12,912	2
		B	....	49.1	46.7	4.2	13,408	..
Castle Gate, egg	Castle Gate	A	1.90	47.1	40.4	10.6	11,857	23
		B	....	48.0	41.2	10.8	12,188	..
Hiawatha, egg	Hiawatha	A	3.42	50.97	39.14	6.47	12,924	1
		B	....	52.8	40.5	6.7	13,382	..
King, egg	Mohrland	A	2.6	48.05	42.65	6.7	12,924	13
		B	....	49.3	43.8	6.9	13,269	..
Liberty	Carbon Co.	A	2.3	49.2	42.9	5.6	13,482	17
		B	....	50.4	43.9	5.7	13,800	..
Royal Utah, stove	Castle Gate	A	1.60	48.1	43.3	7.0	13,187	26
		B	....	48.9	44.0	7.1	13,401	..
Royal Utah, steam	Castle Gate	A	1.8	47.05	42.95	8.2	13,067	29
		B	....	47.9	43.7	8.4	13,306	..
Spring Canyon	Storrs	A	2.1	48.7	42.4	6.8	12,852	37
		B	....	49.7	43.3	7.0	13,128	..
Standard	Standardville	A	2.14	47.2	44.06	6.6	12,948	21
		B	....	48.2	45.1	6.7	13,231	..
Sunnyside, egg	Sunnyside	A	1.70	51.9	38.7	7.7	12,996	24
		B	....	52.8	39.4	7.8	13,220	..
Utah Grand	Sego	A	3.2	52.7	38.37	5.7	12,364	16
		B	....	54.5	39.6	5.9	12,772	..
Utah Grand	Sego	A	2.6	38.0	30.4	29.0	9,621	34
		B	....	39.0	31.2	29.8	9,878	..
BRITISH COLUMBIA COALS								
Corbin	Corbin	A	1.2	68.45	24.5	5.85	14,097	33
		B	....	69.3	24.8	5.9	14,267	..

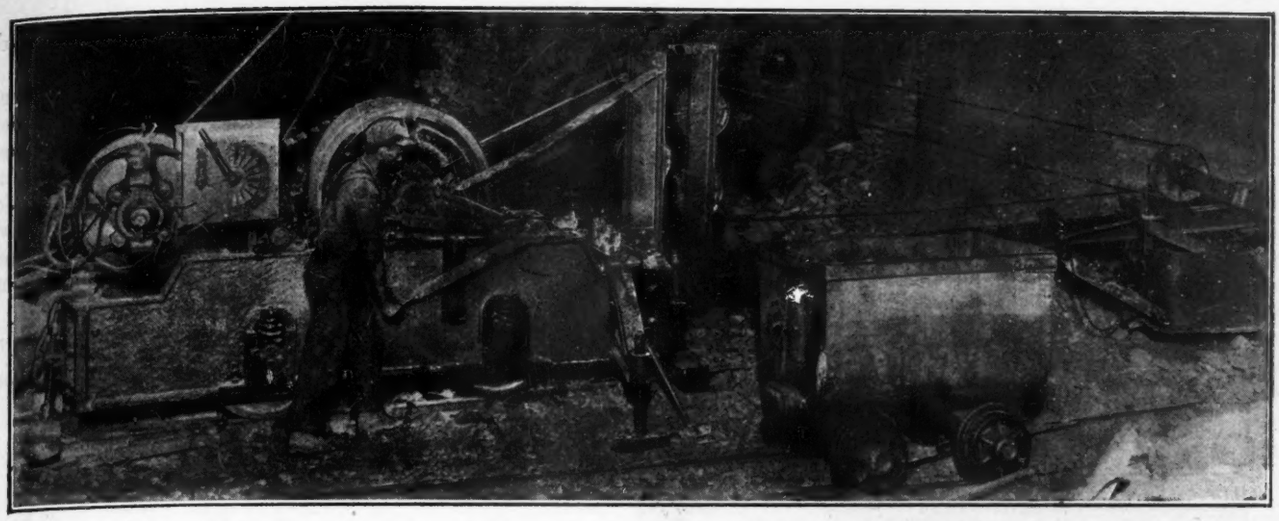
ALBERTA COALS

Name	Origin		Moisture	Fixed Carbon	Volatile Matter	Ash	B.t.u.	No.
Bellevue lump	Bellevue	A	1.1	70.26	22.64	6.0	14,611	7
		B	....	71.0	22.9	6.1	14,772	..
Canadian Anthracite	Bankhead	A	.6	80.3	9.2	9.9	13,116	3
		B	....	80.8	9.9	9.9	13,195	..
Canadian Free Burning	Lethbridge & Tabor	A	7.0	45.1	38.9	9.0	11,488	8
		B	....	48.5	41.8	9.7	12,353	..
Green Hill, mine run	Blairmore	A	1.0	69.05	23.15	6.8	14,635	4
		B	....	69.8	23.4	6.8	14,772	..
Green Hill, furnace	Blairmore	A	1.4	49.05	42.3	7.25	14,599	11
		B	....	49.7	42.9	7.4	14,806	..
Green Hill, steam	Blairmore	A	0.6	65.15	23.25	11.0	13,451	6
		B	....	65.54	23.4	11.06	13,534	..
Internatl. Coal & Coke Co.	Coleman	A	.8	53.3	25.2	20.7	11,847	30
		B	....	53.7	25.4	20.9	11,943	..
McGilvary Creek, mine run	Coleman	A	1.05	60.40	22.25	16.3	13,115	20
		B	....	61.0	22.5	16.5	13,254	..
Spokane & Alberta Coal & Coke Co., Tent Pass Mine	Crows Nest	A	.5	59.4	18.8	21.3	11,966	43
		B	....	59.7	18.9	21.4	12,027	..
Tent Pass Mine Vein No. 8.	Crows Nest	A	4.9	58.2	20.35	16.55	10,148	44
		B	....	61.2	21.4	17.4	10,670	..
Taber	Lethbridge	A	8.2	50.7	34.2	6.9	11,297	35
		B	....	55.2	37.3	7.5	12,306	..
WYOMING COALS								
Clean Burn	Sheridan	A	10.7	45.6	38.3	5.4	10,851	15
		B	....	51.1	42.9	6.0	12,151	..
Kemmerer	Kemmerer	A	1.7	47.3	33.3	17.7	11,596	36
		B	....	48.1	33.9	18.0	11,797	..
Kirby	Kirby	A	6.75	51.9	38.6	2.7	11,881	19
		B	....	55.8	41.3	2.9	12,740	..
Owl Creek, lump	Gebo	A	9.0	51.2	36.90	2.9	12,613	5
		B	....	56.26	40.54	3.2	13,860	..
Owl Creek, egg	Gebo	A	9.5	51.7	36.1	2.65	12,505	10
		B	....	57.2	39.9	2.9	13,818	..
Peacock, Rock Springs, nut	Rock Springs	A	3.8	53.8	40.6	1.8	13,140	28
		B	....	55.9	42.2	1.9	13,659	..
Peacock, Rock Springs, steam	Rock Springs	A	3.5	52.0	39.8	4.7	12,623	27
		B	....	53.9	41.2	4.9	13,080	..
Rainbow Rock Springs	Gunn	A	4.6	53.8	40.0	1.6	12,445	38
		B	....	56.4	41.9	1.7	13,045	..
Rainbow, Rock Springs	Gunn	A	6.6	53.2	38.2	2.0	12,086	18
		B	....	57.0	40.9	2.1	12,940	..
Rock Springs, nut	Superior	A	6.3	52.9	38.8	2.0	12,876	9
		B	....	56.4	41.4	2.2	13,740	..
Star, Rock Springs, nut	Rock Springs	A	5.85	50.1	41.85	2.2	11,919	22
		B	....	53.3	44.4	2.3	12,639	..
IDAHO COALS								
Brown Bear	Driggs	A	2.75	53.4	40.3	3.55	13,259	46
		B	....	54.91	41.44	3.65	13,034	..
Horse Shoe	Driggs	A	2.4	53.75	39.8	4.05	13,235	47
		B	....	55.07	40.78	4.15	13,564	..
WASHINGTON COALS								
Cinnabar	Chehalis	A	6.0	52.05	40.1	1.85	11,679	45
		B	....	55.3	42.7	2.0	12,424	..
Queen, egg lump	Cle Elum	A	2.45	48.95	37.5	11.1	12,122	42
		B	....	50.3	38.4	11.3	12,426	..
Roslyn No. 2, mine run	Beekman	A	1.9	41.1	31.5	25.5	10,057	40
		B	....	41.9	32.2	25.9	10,252	..
Roslyn No. 3, washed steam	Beekman	A	.8	48.5	34.5	16.2	12,206	41
		B	....	48.7	34.7	16.3	12,305	..
Roslyn Cascade, steam	Roslyn	A	1.90	42.6	35.7	19.8	11,129	25
		B	....	43.5	36.4	20.1	11,345	..
MONTANA COALS								
Bear Creek, slack	Bear Creek	A	5.7	44.8	36.6	12.9	11,230	12
		B	....	47.5	38.8	13.7	11,909	..
Bear Creek	Washoe	A	6.2	47.4	39.0	7.4	11,548	32
		B	....	50.5	41.6	7.9	12,311	..
Roundup	Roundup	A	6.6	53.8	29.0	10.6	11,488	39
		B	....	57.6	31.1	11.3	12,300	..
Smith	Bear Creek	A	7.2	50.51	33.55	8.74	11,320	14
		B	....	54.5	36.1	9.4	12,198	..

THE COMPLETE FIRST-AID TRAINING COURSE of the Bureau of Mines was recently given by Mine Safety Car No. 2 to a considerable number of students of the Colorado Agricultural College at Fort Collins and the University of Colorado at Boulder. In Denver 150 city firemen were trained in first aid. The crew of this car also gave first aid in the oil and lignite fields of Texas during the greater portion of the winter. City firemen in Dallas have recently taken the training.

AT THE EXPERIMENTAL MINE of the U. S. Bureau of Mines at Bruceton, Pa., near Pittsburgh, arrangements are being made for conducting a series of tests to determine data relative to coefficients of friction of air currents in mines and loss of head in the air passing around turns and bends and around various mining areas.

A REPORT ON MINING METHODS in the western Pennsylvania bituminous coal region has been prepared by the U. S. Bureau of Mines, with special relation to the thin-vein district. It is planned to incorporate in the report data on mining methods in the thick-vein district and in the Connellsville region.



CONWEIGH SHOVEL LOADER, IN WHICH THE DIPPER SLIDES BACK AND FORTH ALONG A BOOM

Costs of Operation of Shoveling Machines in Mines

Records Made in Metal Mines by Several Types of Loaders—Most Loaders in Metal Mines Use Material Gently—Some Are Built for Narrow Work Only—A Light Type for Coal Mines

IF IT IS unfair to compare coal-cutting costs it is still more invidious to compare those of loading. Hugh Archbald has just published a book entitled "The Four-Hour Day in Coal," in which he shows that by inefficient delivery of cars the miner's opportunity to load coal is reduced to four hours or thereabouts per day. This "unemployment in employment" is a matter that demands correction, but it is still more one that should be overcome in the loading of coal by machinery. A machine which loads rapidly and yet is kept back by the equal turn will barely do more than an hour per day. Given a preference it will do better than that, but even with every arrangement favorable it cannot in driving rooms, especially narrow rooms, have anything resembling a **full** eight-hour run.

The shovel is never any better than the management behind it enables it to be. If cars are not supplied in a steady stream it cannot hope to give a good account of itself. The capacity of our mines is limited by the railroad transportation efficiency, but still more is the capacity of a shovel held down to the opportunities afforded by the car supply at the face of the workings. Given a chance to work equal to that afforded the long-wall mining machine, it will readily do a big day's work, for it demands no effort on the part of the man operating it, so that it is not held back in any way by the inertia of the operative, who furthermore has no incentive by reason of fatigue to keep it from doing a full day's work. In fact, barring a certain disposition to keep out machinery for fear that men will be displaced, the employee is without any conceivable excuse for preventing the machine from accomplishing its utmost. The efficient work of shovels in strip pits, where car deliveries are easily arranged, gives an inkling as to the possibilities below ground if cars could only be furnished with equal regularity.

The Bureau of Mines recently published a bulletin by C. Lorimer Colburn on the work of underground shovels in metal mines, entitled "Underground Loading Devices in Metal Mines," Serial 2,300 of "Reports of Investigations." The unbreakableness and size of the material shoveled in metal mines militates against favorable results. So also does the narrowness of the drifts and the smallness of the cars. It is difficult to arrange for a steady passage of wagons when working at the dead end of a narrow drift. Furthermore the shoveling surface in metal mines is not always favorable to easy excavation. On the other hand, the greater weight per cubic foot of the material lifted, the absence of union restrictions and of the union spirit and the closer and more adept superintendence make conditions more favorable. In metal mines, with some exceptions, the roof is bad, much timbering is necessary, and conditions such as obtain in salt mines, where large roof spaces are permissible, cannot be found. However, in some mines working in chert or limestone the roof is unusually strong and will stand over large areas the like of which no coal mine could possibly leave unsupported. Props are not used in these mines and in some few cases immense areas have been left entirely without interior pillars. The Bureau's results, however, are not all for shoveling under any such favorable conditions.

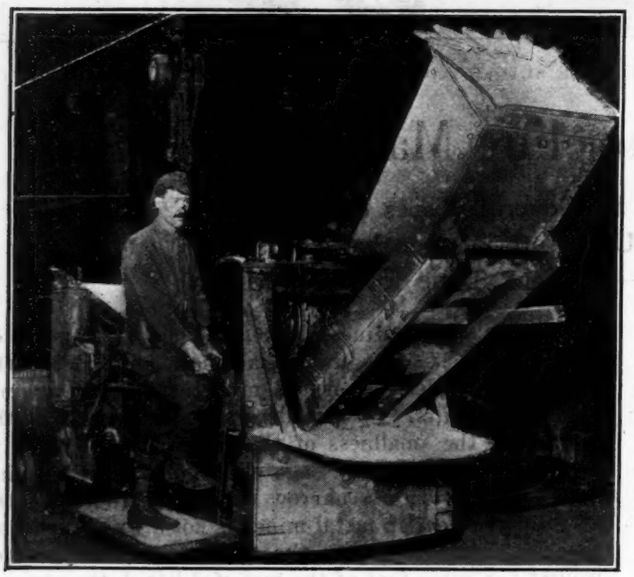
The Hunt rotary shovel,* which has revolving buckets the movement of which is regulated by carefully designed cams and which feeds to a conveyor belt, has all the advantages of the continuity that comes from such a design and it also has the quality of being kindly to the coal intrusted to its care. It is quite capable of handling lumpy material without breakage, as the buckets are large enough to tackle big lumps exceeding those that a man can lift. The Bulletin declares that "the management [at the Mayville Iron Mines of the Steel & Tube Co. of America] states that the machine has loaded as many as 116 cars of three-ton capacity in eight hours." That is about 348 tons in a day, or 43½

*Described in issue of *Coal Age* of May 5, 1921 on p. 789 et seq.

tons per hour. The report adds that "no records of this machine over a long period of time are available."

In one mine visited by Mr. Colburn a Myers-Whaley shovel was installed. It had been in use three years. The management stated that during 1918 more than 30,000 tons of material was shoveled at a cost of 20.07c. a ton. This cost was divided between repairs (9c. per ton) and operating labor and supplies (11.07c.). During 1919 nearly 39,000 tons was shoveled at a cost of 19.15c. per ton, and during 1920 nearly 40,000 tons at a cost of 20.69c. per ton.

The tonnage on individual machines varied according to the thickness of the ore body, the amount of ore available and the time required for switching cars. The average was about 100 tons per eight-hour shift but when it was possible to work five or six hours in one or two



CONWEIGH DIGGER BELT LOADER

The dipper is hinged to the dipper arm and can be swung on this hinge 90 deg. in a vertical plane. Both the front and back of the dipper are open. The dipper arm is so constructed that it forms a trough through which the material slides from the dipper to the belt conveyor.

headings, 130 to 150 tons was loaded. The crew consisted of one operator and one mule driver. The operator would break up boulders while the driver was switching cars.

In another mine a test was made which was observed by a Bureau of Mines Engineer. The machine had one runner, two helpers and a shoveler in attendance. A locomotive was kept constantly at hand for switching purposes. The machine readily shoveled the four and one-half tons necessary to fill the car in three minutes, after which ten minutes was taken to switch the loaded car about 500 ft. and to replace it with an empty. Over a period of two hours this machine handled cars at the rate of one car for every fifteen minutes, or eighteen tons per hour. A shift's work was about 125 tons.

In another mine the Myers-Whaley machine was used to handle material in a slope. The machine in this mine was compelled to work on a grade of from 5 to 10 per cent. It worked nicely on a 5-per cent grade and with difficulty on one of 10 per cent. The working face was 10 ft. high. During the period that observation was made the machine shoveled 2,653 tons, which was at the rate of 12 tons per hour. The costs were as follows: Shoveling, 20.80c.; drilling, 8.71c.; blasting, 15.39c.; total, 44.9c. per ton. The cost of doing the same work by hand was 58.5c. per ton.

In July, 1918, Witherbee, Sherman & Co. purchased for its Harmony mine one No. 4 type Myers-Whaley shoveling machine. In 1920 three additional machines were installed. The material handled was magnetic iron ore. The wage paid the shovel runner was 57½c. per hour, and that of the helpers 47½c. per hour. Five men ran the machine and handled the cars. The average tramming distance was 250 ft. Table I gives information about these costs.

TABLE I. OPERATING COSTS FOR 1920 AT THE HARMONY MINE

	— During Seven Months —			During Twelve Months
Tonnage	12,459	10,365	9,996	12,387
	Cents	Cents	Cents	Cents
Operating labor cost	12.7	14.8	14.8	19.1
Repairs, labor cost	3.1	5.4	3.0	15.0
Repairs, supply cost	8.7	10.1	9.6	28.0
Shops and miscellaneous	0.4	0.1	0.1	3.8
Power	0.4	0.4	0.4	0.4
	25.2	30.8	27.9	66.3

The higher costs for the last machine are mostly in repairs. This machine was bought in 1918 and was practically rebuilt except for motor and frame.

The Conweigh digger belt loader is a shovel having a method of operation that is by no means rough toward the material handled. The shovel lifts the load which when released slides out of the bucket backward onto a belt conveyor. The dipper can be swung 90 deg. in a vertical plane. A 15-hp. motor provides the power. Standing on a platform at the side the operative can readily see and direct the digging operations.

The machine has been in operation in the mines of the National Lead Co., St. Francois, Mo. The record for the month of February, 1921, was an average of 96 tons of ore loaded in an eight-hour shift with one operator and one helper; 3,360 tons was loaded during the month. These two men not only load the cars but push the empty one-ton capacity cars to the machine and deliver the loaded cars to the motor haulage loop. A labor cost of 9½c. per ton was reported for the February operation. To this should be added the cost of power and repairs. The management expects to reduce its present loading costs of 16.64c. per ton by using this machine.

In some ways the Conweigh shovel loader closely resembles the machine devised for the Locust Mountain Coal Co. by Mr. Brown and described in *Coal Age*, March 3, 1921, p. 395 et seq. It consists of a boom mounted on the forward end of a steel frame. A dipper slides back and forth on the boom, which can be swung to either side or up and down. This machine also is not unsuited for coal loading, as it does not unduly break the material it handles.

The machine is controlled by an operative who stands to the right of the machine. The movement of the dipper and boom is controlled by two levers. The dipper is pulled into the pile of material and after filling itself is raised over a car, which may be placed on a track laid on either side of the machine as desired. As soon as the dipper is over the car the operative pulls a rope and the bottom is tripped, releasing the load.

During 1920, at the St. Louis Smelting & Refining Works of the National Lead Co., St. Francois, Mo., 169,351 tons of ore was loaded by seven of these machines, which made an average of 62.4 tons loaded per shift. The average was 16.64c. per ton. The costs were distributed as follows: Operating labor, 14.9c.; repair labor, 0.30c.; supplies, 0.99c.; power, 0.44c.; total, 16.64c. per ton.

The Shuveloder needs no description, having been

used for some time in coal mines for loading rock and bottom clay, falls and the like and in the Bellingham mines of the State of Washington for loading coal also. It has been described in an earlier issue of *Coal Age*.

One man operates the machine and another switches the cars. In some places where digging is quite difficult a third man is used as a helper. At one mine the loader was used intermittently. Working on rock it shoveled 72½ cars of 2⅛ tons capacity in 35½ hours, or 5.7 tons per hour, at a cost of 25.09c. per ton. This included tramming the cars 370 ft. The actual time of loading was 16¼ hours. The delays were due to tramming, switching, derailment of loader and repairs. In another test, working on soft iron ore, 208 cars were loaded in 139¼ hours at a loading cost of 12.97c. per ton. The actual loading time was 24½ hours.

An Armstrong No. 11 shovel was in use at the Colby mine of the McKinney Steel Co., Bessemer, Mich., to load broken rock in driving drifts. The drifts are 7 ft. high by 8 ft. wide, and the pile of rock is about 19 ft. long and about 4 ft. high at its deepest place. There are about fourteen carloads of 32 cu.ft. capacity to the pile. Two men were used in loading—one operative and one attendant who switched the cars. The machine was observed during the shoveling of one of these piles of material, with the following results:

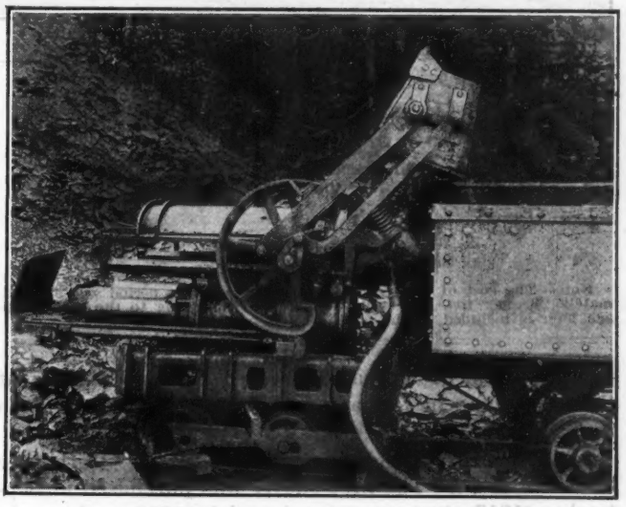
Total time of setting up machine, 10 minutes; time of loading fourteen cars, 58 minutes; 12 move-ups of loader, 30 minutes; switching twelve cars, 92 minutes; total, 190 minutes. Total number of cars loaded, 14; total cubic feet, 448; total number of move-ups, 12; total number of loader dippers, 222. Average number of loader dippers to a car, 16; average number of loader passes per minute, 4; average time for loading cars, including move-ups, 6 minutes; average time for loading one ton of rock, including move-ups, 2.4 minutes. Total time required for setting up the Armstrong shovel, loading and tramming of the rock, broken from an average break of a round of holes took one hour and 45 minutes.

Shovels Now Installed Have Rigid Boom

The Thew shovel when it first entered the coal mines was a top-lofty machine that could be used only in mines like that at Hanna, Wyo., where the deposit was more than 30 ft. thick*. It has been redesigned, as the illustration shows. The capacity is about ⅝ cu.yd. The boom is rigid, being built up of steel so as to require the minimum headroom. The operating mechanism consists of a 20-hp. motor and the necessary gears and other mechanical parts to operate the machine. The operating mechanism is mounted on a platform. Below the platform is a turntable which revolves the entire shovel through a full circle of 360 deg. The entire machine is carried on the truck, which is on a caterpillar tractor. The machine is self-propelling.

The operative has a seat on the platform which supports the operating mechanism. From this seat he can observe the action of the dipper and can also keep watch over the performance of the operating mechanism. The different motions of the shovel are controlled by levers. The dipper is forced into the pile of material by a movement imparted to the dipper arm and the pulling of the dipper chains. When the dipper is full the dipper chains are tightened so as to pull the dipper into a vertical position. The shovel is then swung on its turntable until the dipper is over the car. The bottom of the dipper is then tripped, allowing the material to drop. It will be observed that this shovel also will not unduly break the coal.

The Vinegar Hill Zinc Co., Platteville, Wis., has operated Thew electric shovels in its mines in the Oklahoma-Kansas-Missouri district and in the Wisconsin-Illinois district. At the Barr mine, in Kansas, near Picher, Oklahoma, the ore body is mined in stopes from 20 to 45 ft. high by the mining method common to the district, but cars holding 1½ tons instead of ½-ton cars are used, and accordingly the shaft is equipped with cages. A type O Thew shovel was installed in April, 1919. This is a standard type, revolving in the full circle, and is self-propelled, mounted on a 4-wheel truck. It was found to be more flexible than other loaders then being tried in the district, because the full-circle swing allows ore to be loaded at any point—front, back or to either side—within the radius of the boom. Three dipper loads fill a 1½-ton car. Over a period of twenty weeks' operation the average loading per eight-hour shift was 160 tons at about one-half the cost of hand shoveling.



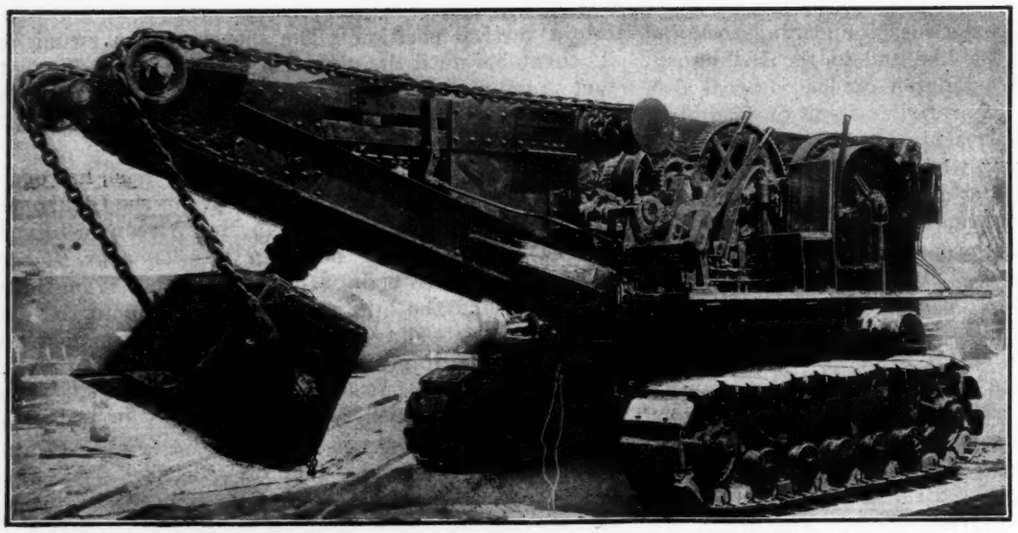
SHUVELODER LOADING FROM A STOCKPILE

At many collieries these machines are loading bottom and brushed rock, rock falls and coal. They have four cylinders, all operated by compressed air. The machines are propelled by hand. Immediately above the truck and beneath the main body is a turntable that provides a swiveling movement. The headroom required is 82 in. The machine will load any car 50 in. high or less.

At the Meloy mine, New Diggings, Wis., two type O Thew shovels have been installed. The shovels, like that at the Barr mine, are electrically driven and self-propelled and are mounted on wheels. The headroom required is a minimum of 16 ft. and the operating width needed is at least 20 ft. The stopes are 50 ft. by 25 ft. wide, providing both ample working space and sufficient broken ore so as to insure that the shovel may be kept in continuous operation. Dippers of both ⅝ cu.yd. and ¾ cu.yd. are used. The machines weigh about 15 tons, but can be readily disassembled so as to lower through a 6 x 6 ft. shaft compartment.

A crew consists of one operative, who should be a careful and experienced man; one helper, unskilled; and one mule driver and mule, handling 1½-ton cars. Such a crew, under suitable conditions, should easily load 175 to 230 tons per 9-hour shift. Table II shows the operating record for the period between Nov. 24, 1917, and Aug. 16, 1919, for one of the shovels at the Meloy mine.

**Coal Age*, Dec. 5, 1918, p. 1018; as shown on p. 1016 of the same issue a shovel had been constructed of smaller dimensions.



Thew Underground Shovel

This excavating shovel has learned to crawl since it went underground, as we all do soon after entering coal mines. It is operated by electricity. Its bucket will hold ⅝ cu.yd. and its motor is a 20-hp. machine. The shovel can be revolved 360 deg. on a turntable placed below the platform.

TABLE II. SHOVEL OUTPUT AT MELOY MINE

Total shoveled, tons	27,177
Total shifts worked	211
Average working time per shift, hours	3.85
Average tons shoveled per hour	33.4
Average tons shoveled per shift	129.3
Cost per Ton	Cents
Labor	11.06
Power	0.70
Repairs	1.09
Total, cents	12.85

Note—The cost of hand shoveling during the same period was approximately 23c. per ton. In both instances the tramming to the main haulage loop is included in the cost.

A two-months' operating record for two shovels at the same mine in January and February, 1921, is given in Table III.

Five Thew shovels were purchased by Witherbee Sherman & Co. The first shovel was purchased in September, 1917; two were purchased in 1918, and two in April, 1919. Three of these shovels were put into operation at their Harmony mine. In Table IV is given the record of these three shovels for the year 1920.

The ore was hauled away from the shovel in 54-cu.ft. gable-bottom cars. The Thew shovel in No. 2 stope worked against a 40-ft. face. The vein at this point was 60 ft. wide. Tracks were laid on either side of the shovel. The shovel loaded the car on one track and then filled that on the other while the first car was being trammed to the shaft and emptied. It took four minutes to dump the car and return it to the shovel. The shovel had difficulty in picking up large lumps and scraping the bed rock.

A Thew shovel is working in one of the large stopes in the Mascot mine of the American Zinc Co., at Mascot, Tenn., where the ore is a sphalerite and occurs in limestone. The mine has an open stope about 200 ft. high. The ore is loaded into steel cars of about two-ton capacity and hauled by mules to a side track, from which

TABLE III. RECORDS OF TWO SHOVELS AT MELOY MINE

	Total Tons Shoveled	Total Shifts Worked	Hours per Shift	Labor Cost per Ton	Power Cost per Ton	Repair Cost per Ton	Total Cost per Ton
Shovel No. 1	10,987	80	7	11.7c.	1.3c.	0.7c.	13.7c.
Shovel No. 2	5,917	42	7	11.3c.	1.3c.	0.7c.	13.4c.

Note—The cost of hand shoveling during the same period was approximately 16c. per ton. In all cases the cost of tramming 200 ft. to the shaft was included in the labor cost.

place the cars are taken to the shaft bottom by electric storage-battery locomotives. The stopes are quite large, so that there is plenty of room for the machine to operate. This shovel was put in operation in August, 1920, and in the succeeding three months handled 6,335 tons of ore at a cost of 17.55c. per ton.

In 1918 the Chateaugay Ore & Iron Co., of Lyon Mountain, N. Y., introduced a Thew shovel into its No. 4 mine. Records of performance, cost and upkeep were not kept. Another shovel of the same make was procured for the No. 5 mine, but was used very little and was later transferred (March, 1919) to the No. 1 mine. Labor costs for the Thew shovel in No. 1 mine are: One operative, $5.25; one operative's helper, $4; three trammers, at $4 each, $12; total, $21.25.

Two hundred tons of ore was handled per shift, making a cost for labor of 10.62c. per ton. This shovel worked in a large stope 40 ft. wide and 45 ft. high. Cars were pulled in and drawn out by mule. A switch was arranged 100 ft. from the shovel, and the cars

TABLE IV. RECORDS OF THREE SHOVELS IN HARMONY MINE

	Thew No. 1	Thew No. 2	Thew No. 3
Tonnage	23,398	26,134	27,720
Distance trammed	158	210	395
	Cost, Cents per Ton		
Operating, labor cost	16.2	14.9	16.0
Moving, labor cost	01.2	00.3	00.7
Repairs, labor cost	06.6	02.1	02.6
Repairs, supply cost	10.0	05.2	07.0
Shops and miscellaneous	04.1	01.6	01.9
Power	00.4	00.4	00.4
Total cost	38.5	24.5	28.6

pushed up to the shovel by hand for this distance. Side-dump cars of 40-cu.ft. capacity were used; they hold 2¼ tons. Much time was lost in switching cars.

At the No. 4 mine also a Thew shovel was in operation. This shovel handles 300 tons per day, at a cost for labor of 6c. per ton. A tail rope is used for switching cars. Two tracks lead to the shovel, so that one car is being loaded while another car is being pushed in. The shovel operated almost continuously. The full haul for cars is 600 ft. Alternating current at 220 volts was used. Power cost about 2½c. per kw.-hr., or about $1 per day per shovel. The shovel was often out of commission on account of repairs. The most serious trouble experienced was the breaking of an I-beam on the No. 1 shovel. The rawhide pinions soon wear out, the average life being about three weeks. It is estimated by this company that the cost to handle ore by hand was 35c. per ton in the No. 1 mine, and in the No. 4 mine

44c. per ton. Labor and supplies consumed in repairs added in general about 5 or 6c. per ton to the mining cost.

The St. Joseph Lead Co., of Bonne Terre, Mo., operates six Thew shovels at its mines. The stopes are large, giving ample room for operation. All of these machines were put in operation in 1920. The record of their performance is as follows: Thew No. 1 loaded 8,713 tons at a cost of 14.98c. per ton. Thew No. 2 loaded 26,970 tons at a cost of 18½c. per ton; Thew No. 3 loaded 12,194 tons at a cost of 18.8c. per ton; Thew No. 4 loaded 20,917 tons at a cost of 16.65c. per ton; Thew No. 5 loaded 4,969 tons at a cost of 29.34c. per ton; Thew No. 6 loaded 4,881 tons at a cost of 28.13c. per ton.

The higher costs for shovels Nos. 5 and 6 are due to their being used in mines where conditions are less favorable for their operation, the stopes being smaller and the operation of the machine being frequently interrupted. The average for all six shovels is 78,644 tons loaded at a cost of 19.96c. per ton. These costs are distributed as follows: Operating labor, 11.025c.; repair labor, 4.115c.; material, 2.895c.; power, 0.933c. per ton.

Although the Marion shovel is not manufactured primarily for underground use, the smaller-sized machine has been used underground by several mining companies. The American Zinc Co. installed one in August, 1920, in its mines at Mascot, Tenn. Records of performance for three months are as follows: Total ore handled, 8,997 tons; cost, 19.7c. per ton. Labor costs were 17.60c. and repairs 2.11c. As this was a second-hand shovel, the repairs were a little higher than usual.

A Marion shovel with ¾-yard dipper is in use at the 1,650-ft. level of the United Verde Mine at Jerome, Ariz. The cost of loading ore into chutes with this shovel is estimated as being less than for doing the same work by hand. The great weight of the machine makes it expensive to move in or out of a stope and because of its large capacity it often has to be kept idle, waiting for ore. The advantage of the machine is that it loads material faster than it could be done by hand.

Air Shovel for Use in Narrow Quarters

The Hoar underground shovel uses a dipper and is operated by compressed air, three sets of air engines being necessary to control the various movements. These air engines are located in the body of the machine. A turntable which enables the machine to be swung through a complete circle is located between the body and truck. The truck runs on the ordinary mine track. The standard size machine requires an operating space 7 ft. wide by 6 ft. high. Its weight is 5,800 lb.; air pressure required, 90 lb.; air connections, 1½ in.

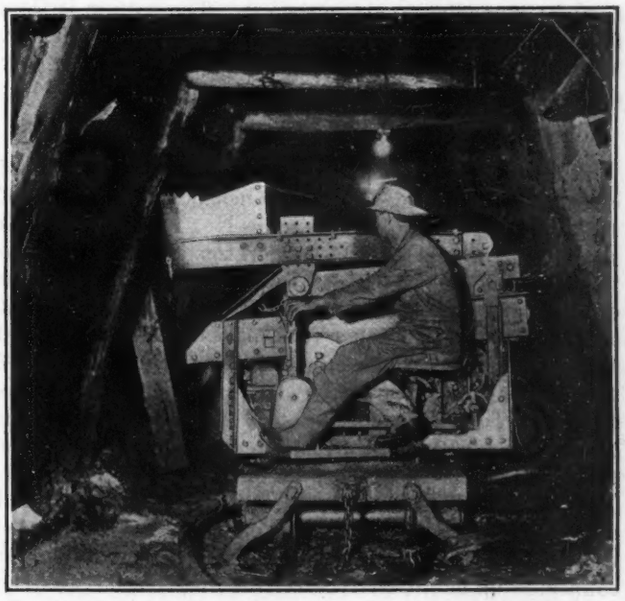
The Hoar underground loader is not self-propelling and therefore must be pushed to its working place. It is then clamped to the rails. Having a full-circle swing, the machine can load cars to either side or to the rear. The operative has a seat on the small platform on the left-hand side of the body of the machine. Being well above it he can observe the movement of the dipper. The machine is controlled by three levers which are placed conveniently for his operation.

In digging, the dipper is forced into the pile of material by the forward motion which the engine gives to the dipper arm. At the same time another engine winds the cable onto the drum, which, acting as the lever, forces the dipper up through the pile. As soon as the dipper is raised free of the pile of material the entire machine is revolved on the turntable until the dipper is brought over the top of the car; then the bottom of the dipper is tripped, allowing the material to fall.

The Hoar underground shovel has been introduced into only a few mining districts, the manufacturers having found a ready market in the Lake Superior iron mining district for their entire output. Little effort has been made to introduce the machine in other regions. It is being used in drifts, subleveling work, stoping, to clear out sumps, and also on the surface to shovel coal from the coal piles for use in boilers. The cost of operation varies considerably, depending upon the conditions, the range being from 17c. to $1.08 per ton.

In shoveling the well-broken material in places where there was plenty of room, an average of 135 tons was loaded in 24 hours at a cost of 17.9c. The wages of the attendants were: Operative, $5 per day; helper, $4.75 per day. In another place, where the material was wet and sticky and contained many large lumps, the machine loaded over 8,500 tons in two months at a cost of $1.08 per ton. The mine management estimated that to have done the same work by hand would have cost $1.60 per ton. The wages of the attendants were: Operative, $8, and assistant, $6 per day. In the case of sublevel stoping, the machine handled more than 1,700 tons of material in one month at a cost of 65c. per ton.

In the latter part of 1920 a Hoar underground shovel was put in operation at the Montreal iron mine. At the same time similar work was being done by hand, so that it is possible to compare the costs by the two methods. Comparison can be made between the work done on the 23d and 24th levels, the driving being done in the hanging wall in both instances. The type of ground was practically the same and the other conditions also were fairly equal. The 23d level drift was extended, using hand loading alone. The cost for labor was $12 per foot, over a period of 7 months, and during



HOAR UNDERGROUND SHOVEL FOR NARROW PLACES

This operates by compressed air, three engines controlling the various movements. A turntable is located between the body and the track. Thus it can be swung in a complete circle. It can be operated in a space 7 ft. wide by 6 ft. high and weighs 5,800 lb. It works on 90 lb. air pressure, using a 1½-in. air connection.

this time the drift was advanced 469 ft., or at the rate of 67 ft. per month.

In the 24th level east drift, the Hoar underground shovel was used and the drift was advanced 270 ft. in 3 months, or at an average of 90 ft. per month. The labor cost amounted to $6.62 per foot and the repair and supply cost was $1.24 per foot, making a total of $7.86 per foot. At the same time the shovel was used to handle material on the 24th level west at a labor cost of $6.21 per foot and supply and repair costs of $1.24 per foot, making a total of $7.45 per foot. The saving in the east drift of the 24th level was $4.14 per foot and the saving in handling the material from the 24th level was $4.55 per foot.

TABLE V. COMPARISON OF HAND AND MACHINE LABOR, MONTREAL MINE

	Hand Labor	No. 2 Hoar Loading Machine
Location	23d level	24th level
Material	Iron ore	Iron ore
Size drift	10 x 10 ft.	10 x 10 ft.
Time of test	7 months	3 months
Total footage	469 ft.	270 ft.
Total tonnage	3,906 tons	2,250 tons
Monthly footage	67 ft.	90 ft.
Monthly tonnage	558	750

The Keystone Driller Co. has for several years manufactured and placed on the market an excavator mostly used on road work and also in digging cellars and ditches. This machine consists of an upright boiler with an engine mounted on a tractor, and a dipper operating on a boom. The Federal Lead Co. purchased several of these machines and remodeled them to be used in their mine at Flat River, Mo. In order to adapt the Keystone to underground mining it was necessary to replace the boiler and engine by an electric motor.

The operation of the machine as adapted by the Federal Lead Co., Flat River, Mo., is as follows: The operative stands on the main platform, where the movements of the dipper can be observed. By levers, the boom can be lowered and the dipper pulled into the pile of material by a cable operating over the pulley at the end of the boom. The boom can be lowered, raised or swung by the second cable. As soon as the dipper is filled the boom is raised and swung until the dipper is brought immediately above the car. The bottom is then tripped, allowing the material to discharge into the car. The machine is given stability by two braces on either side of the machine at the front.

Loaded Three-Quarter Million Tons at 18c.

During the year 1917 in mine No. 12 48,917 tons of ore was shoveled by the Keystone shovel at a cost of 18.24c. per ton. In 1919 in mine No. 1 8,313 tons was shoveled at a cost of 19.11c. per ton and in the same year in mine No. 12 318,819 tons was shoveled at a cost of 16.4c. per ton. In 1920 370,373 tons was shoveled at a cost of 19.03c. per ton. This makes a total of 746,000 tons of ore thus shoveled, giving an average cost of 17.85c. per ton. The distribution of these costs is as follows: Tons of ore per shovel shift, 126.1; supplies and repairs, 2.10c. per ton; maintenance labor, 12.57c. per ton; power, 1.35c. per ton; total, 17.85c. per ton (sic).

The Golden Rod Mining Co. at Tar River, Okla., used a ¾-cu.yd. Keystone shovel for loading ore. The shovel was operated for 3 or 4 months in 1918. The boiler was connected up as an air receiver, and the engine was run by compressed air. The ore was from 30 to 50 ft. thick. In this work the shovel did not prove satisfactory. It was mounted on a truck and was difficult to move around. The main reason for its failure was the necessity of emptying the dipper into 1,000-lb. cans; a large portion of the material was always spilled and had to be shoveled by hand.

For the records given in this article full credit should be given to Mr. Colburn's brief, which should be consulted in its entirety by those who are interested in this subject. The comment, however, on these shovels has another source, for the most part, especially the reference to coal-mining conditions underground. The bulletin gives valuable data also regarding the use of scrapers in metal mines, where such machinery has long been in successful use. Unfortunately the labor costs in the bulletin are mostly in dollars and cents and not in labor units, which would be more readily translatable. As wages have varied they are not even comparable as between the various years' experience in the same mine. As interest, depreciation and obsolescence are omitted, the figures are likely to be misleading. These items often spell the difference between acceptance and rejection. In some cases, however, repairs which should have been covered by earlier depreciation allowances have caused costs to be unduly high.

Reciprocating vs. Rotary Car Feed to Shovel

There is little question but what the machinery described in the bulletin should find general use in coal mines where the conditions are not so difficult as to make the machines unavailable. In fact many of them are doing excellent work in coal mines already. The factors militating against their use are the difficulties with labor and the lack of sufficient and efficient superintendence. To a machine having large capacity a continuous supply of cars must be afforded. The heavier and more expensive the machine, the more need for such attention; otherwise the overhead costs will decrease the profit materially. In fact so important is this feature that manufacturers having in mind the multiplicity of narrow workings and the almost inevitable irregularity of car supply are providing units of small size and of less efficiency, which they feel assured will suit the needs of the coal industry better than larger machines of greater capacity but also of greater cost.

The Jeffrey mine-car loader is designed on the principle that when the car movement is reciprocating and not rotary (if these terms may be excused) it never can be really satisfactory. Where cars must be brought to the loader and backed away after being filled, delays are inevitable. Only when trips can be steadily passed by the working face and taken out another way can a car be presented to the shovel for loading as soon as the previous car is filled.

Simple vs. Inter-related Shovel Efficiency

Hence, it is argued that as delays are inevitable it is well not to tie up too much money in a shovel, even if by having a less efficient machine the time of loading is somewhat increased. Suppose one shovel can load a car in two minutes and has to wait ten minutes for another, its actual capacity is only one car in twelve minutes. If then another takes ten minutes to load a car and then has to wait a further ten minutes before loading the next, its actual capacity is one car in twenty minutes.

Thus though the first shovel appears to have five times the capacity of the other, the actual capacity is not five times but only 66 per cent greater. When the car delays are longer, and they always are likely to be, then the percentage of relative capacity will fall

still lower. Only ideal conditions will enable cars to be presented so fast that the delay between cars will not exceed ten minutes. The time taken in moving the shovel from one working place to another will still further diminish capacity. It is this which has made the large-capacity shovel less effectual than at first sight it would appear to be. The large first cost which adds so much to the expense of operation and the idle time which seems inevitable under present operating conditions add to the argument against such shovels.

Loaders therefore that are not shovels but mere loaders which themselves have to be loaded, but being loaded will raise the coal, transfer it and drop it into the car, seem to have a reason for being which their lower speed of operation and their imperfect service would seem to deny them. They also are more flexible and can be used where the roof is not particularly good and the coal is thin. Consequently this machine, which is loaded by hand shoveling, is rated at 50 to 60 tons a day under actual working conditions in rooms and each machine is intended to get its output from two working places only. The handling of the cars should be carefully planned that tracklaying, timbering and the like is not done by the loading crew.

The Service Coal Mining Co., at Fordham, Pa., made the record in Table VI with a mine-car loader of the type mentioned, between Aug. 16 and Sept. 1, 1921, in the Lower Freeport seam which ran from 46 to 54 in. thick. The mine worked 11½ days. Two men operated the machine and one motorman provided cars.

TABLE VI. TONNAGE LOADED AT SERVICE COAL MINING CO.'S MINE

Work Performed		Cost	
Cars loaded	416	Two men loading, per day	$7.50
Coal per car	2,800 lb.		$15.00
Total tons	582	One motorman, $7.50 per day	7.50
Average tons per day	50.6		
		Total	$22.50
		Cost per ton for loading and shifting	45c.

The daily reports are given in Table VII. They show that much time was wasted waiting for cars. The coal was loaded from headings which made many more moves per day necessary than would be required if the coal had been obtained from rooms.

TABLE VII. SAMPLE DAILY REPORTS OF COAL LOADING AT SERVICE COAL MINING CO.'S MINE

Number of cars loaded	37
Five moves	1 hour 30 min.
Two wrecks of loaded cars	1 hour
Total time loading and changing cars	5 hours
Number of cars loaded	40
Five moves	1 hour 20 min.
Splicing cable	30 min.
Total time loading and changing cars	5 hours 40 min.
Cleaned up four headings and one room.	
Number of cars loaded	16
Waiting for power	1 hour
Arrived at face, 8:30 a.m.; left at 11:45 a.m.	
Total time loading and changing cars	3 hours 15 min.
Working force	One man and motorman
Pump broke down at boiler house making suspension necessary.	
Number of cars loaded	35
Six moves	1 hour 10 min.
Waiting for cars	40 min.
Arrived at face	8:20 a.m.
Total time loading and changing cars	4 hours 50 min.
Number of cars loaded	44
Waiting for cars	40 min.
Arrived at face	8:40 a.m.
Total time loading and changing cars	5 hours
Loaded ten cars out of one room in 1 hr. and 8 min.	

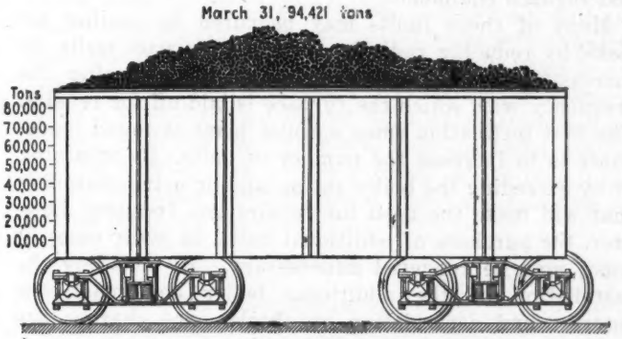
It will be seen that this record might have been bettered had conditions been a little more favorable—for instance, had fewer moves been necessary, the tracks been such as to reduce accidents, the power been steadily available and the runs been longer.

Getting Up Enthusiasm to Break a Record

BACK in February the officials of the Weston Colliery of the Locust Mountain Coal Co. began making preparations to get out all the coal possible during the month of March. The previous record for this operation for one month was 61,146 tons, but it was believed that 85,000 tons could be prepared. Accordingly this was set as the goal to be sought.

Such a tonnage, however, could not be attained except through the enthusiastic co-operation of all concerned. In order to obtain this and arouse the interest of everybody, the following plan was adopted. Each foreman and subforeman was furnished with a chart similar to that shown in the accompanying illustration. This is supposed to represent a railroad car having a capacity of 85,000 tons, and the idea was that the colliery should fill it during March.

Each day the foremen marked on the car the amount of coal mined. Each half hour also announcement was made of the amount of coal dumped during the previous 30 minutes. This resulted in everyone from the general superintendent down to the smallest trapper boy taking an intense interest in the production. When



VISUALIZING PROGRESS INCREASES EFFORTS

Weston Colliery decided to load 85,000 tons in a month, 24,000 tons over previous records. On a chart such as that above the foremen recorded the coal loaded each day. With such an objective clearly in everyone's mind the output was exceeded by nearly 10,000 tons.

dumping was slow even the picker boys would start yelling for more coal.

A spirit of co-operation was thus engendered throughout the entire colliery force and each employee strove to do his best. As a result not only was the "car" filled but 9,421 tons was added as "topping." This brought the month's production to 94,421 tons, or 33,275 tons above the previous monthly record. This increase amounted to over 50 per cent, and on the whole was considered entirely satisfactory.

CONFERENCES HAVE BEEN HELD at the Alaska experiment station of the Bureau of Mines, at Fairbanks, with miners and prospectors in regard to the mining possibilities of the Kantishna and Copper Mountain districts. Local interest in the use of lignite from the Nenana field continues. The heating plant at the Fairbanks station, especially designed for this fuel, has proven eminently satisfactory, and the conversion of the public-school heating plant from wood to lignite is being discussed.

TEST RUNS HAVE BEEN MADE by J. D. Davis and J. F. Byrne at the Pittsburgh (Pa.) experiment station of the U. S. Bureau of Mines to determine the relative tendencies to spontaneous combustion of different parts of the Freeport coal seam, the critical temperatures being 185, 190 and 207 deg. C. The coal below the floor is very rich in anthraxylon and runs 4.4 per cent sulphur, of which 3 per cent is pyrite and marcasite.

Savings That Can Be Effected by Tight Boiler Settings, Proper Baffles and Reductions in Furnace Repairs

Suggestions for Rapid and Enduring Furnace Renewals—Radiation from Furnace Walls Should Be Prevented—Fireclay vs. Refractory Cement—Tight Baffles Increase Availability of Heating Surface—Air Leaks Lower Temperature of Flue Gases

BY ALPHONSE F. BROSKY*
Pittsburgh, Pa.

WHERE a mine generates its own power many are the troubles arising in the boiler room, the place from which all operating energy is derived. Such a mine may be said to be no better than its boiler room, and the superintendent no more successful than his furnace equipment will allow him to be. In fact what has made many operators purchase power or, at least, has reconciled them to its purchase has been the difficulties encountered in boiler operation, largely arising from the inefficiencies and inadequacy of their boiler and furnace equipment.

Many of these faults may be cured by sealing air leaks, by reducing radiation from the furnace walls, by increasing the duty of boilers, while decreasing the frequency with which the furnace is laid off for repairs. The first inclination when a boiler plant is found inadequate is to increase the number of units. By attaining or by exceeding the boiler rating and by using materials that will make the need for repairs less frequent, however, the purchase of additional units, in many cases at least, may be rendered unnecessary. By avoiding the installation of the additional boiler equipment the interest and depreciation or obsolescence charges are not increased and as in making the changes economies are attained in the use of fuel, a reduction also is made in the cost of operation.

WITH GREATER HEAT BETTER FURNACES NEEDED

One of the major difficulties in furnace building and maintenance is the inability of firebrick and its bonding material to resist the high temperatures and expansional stresses to which it is subjected. Yet the troubles with the inferior refractories, too often in use, would be more frequent were mine boiler plants forced to high capacities. As the peak load and consequent furnace temperature rises higher and higher, the life of the low-grade refractory is proportionately shortened. It is not unusual to hear of a plant running its boilers at 250-per cent rating. When such service is demanded something is bound to fail if the brick and other material in which the boiler is set is not of a highly refractory character.

Heavy production periods make runs beyond the boiler rating profitable, but unfortunately the course which makes the increase in power possible not infrequently causes rapid deterioration of the setting. The intense heat melts, or at least softens the brick, and sooner or later units thus affected must be taken off the line, possibly when they are most needed. The solution of this problem lies in the use of better refractories, employing these materials how and where they are needed and making designs suited to their use. In the long run it is much cheaper to use a good refractory than an inferior one, and many concerns will supply brick that will suit any demand.

It must be borne in mind that the softening temperature of the refractory purchased should exceed the temperature to which the material is likely to be exposed. The melting point alone should not be the guide in choosing a fire-resisting material. Before the refractory reaches its melting temperature it enters into the plastic state. That temperature may be some hundreds of degrees lower than the melting point, and when it is reached, the plastic material may be deformed by stress.

Of course, brick may be ruptured by stresses when cold but the principal failure of firebrick arches is from deformation under the combined influences of heat and stress. Furnace walls usually fail through rupture due to continual expansion and contraction aided by load stresses, or through the deterioration of the materials of which the brick are made. It is needless to say that where extreme heat is to be encountered only the best brick should be selected.

After the choice of firebrick the next problem is to decide upon the bonding material to be used. One of the most important factors in prolonging the life of any refractory is the attention which is paid to joints. A theoretically perfect furnace lining would be one with no joints whatever. To this end in some European countries the bricks are ground to fit snugly and are laid up dry, but the cost of providing for such a tight fit is so high that it has found no imitators in this country. Almost as good results may be obtained by joining the bricks with a thin filler of fireclay or, preferably, with a high quality of refractory cement.

If fireclay is used it should be of a quality at least equal to that of the brick. It would be incongruous to use second-quality fire clay for laying first-quality brick. Where the heat to which the brick is to be exposed is moderate, fireclay can be advantageously employed. The

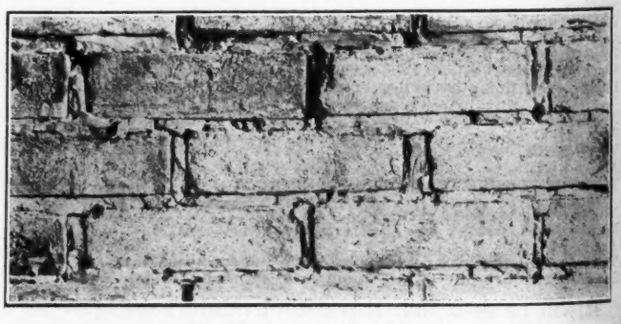


FIG. 1. BOILER WALL, BRICKS SET IN FIRECLAY

Note how the clay has disintegrated, cracked and fallen away, leaving the edges of the brick exposed to the flames, ready to be fused. Thus exposed the faces are sure eventually to succumb to the high temperatures.

*Bituminous editor, *Coal Age*.

FIG. 2. BRICK SET WITH REFRACTORY CEMENT

Here the edges are protected and the flames cannot lick the edges of the brick and start their destructive work. The joints are the weak places in brick set up with fireclay.

use of a good quality of clay properly applied (avoiding any excess and laying a tight brick-to-brick joint) is helpful in attaining greater furnace efficiency. After all, a fire arch is no stronger than its joints. If it is incorrectly laid and if a poor quality of jointing material is used which melts and runs, the furnace will settle, crack and finally be destroyed. Open joints make the lining susceptible to destructive action, for they increase the area exposed to the heat. Because of its shrinkage and its inability to bond tightly fireclay has been displaced to a great extent by cements.

Several cements are now available which resist fire more satisfactorily than fireclay. The first cost of these is higher, but the ultimate cost is less than that of the jointing material they replace. A good cement will not fuse within the range of temperature of the boiler furnace. At all heats it maintains an exceptionally strong bond. In consequence the deterioration of the boiler lining is even.

Prior to the introduction of these cements the life of the furnace was limited by that of the bonding material used. When the proper cement is employed the life of the furnace is determined by that of the brick. If after laying, a thin cement wash is applied to the surface of the lining, the life of the firebrick is lengthened. Such a coating prevents clinkers and slag from securing as tenacious a hold on the furnace as they would if the surface were of brick. Where the slag forms on the brick itself it adheres so tightly that when broken away portions of the brick not infrequently come with it.

A heat-resisting cement called "thermolith" is furnished by the Harbison-Walker Co. The base of this refractory is a chrome ore. Under ordinary atmospheric conditions it sets upon drying and retains its strength and durability even at temperatures beyond those which boiler furnaces are likely to attain. After the setting and the boiler connections are completed, the brickwork should be dried out thoroughly, first by opening the damper and ashpit doors and allowing the air to circulate freely through the furnace, and next by a light fire which is slowly increased in intensity. The cement and brick can be safely dried in this manner and the cement properly seasoned.

Several grades of cement, each suited to different degrees of heat, are prepared by the Celite Products Co. When these are heated they harden and adhere to the brick.

To keep the furnace from radiating heat from the side and end walls, and thereby to conserve fuel, insulation may be used in the walls of boiler settings. Approximately 4 per cent of the total heat generated in a boiler furnace may be lost by conduction through the walls of the setting. This loss may be lowered to 1½ per cent by interposing an insulating brick such as the Celite Sil-O-Cel between the firebrick and the exterior walls.

A refractory cement which vitrifies at 1,450 deg. F. and withstands temperatures up to 3,100 deg. is made by the Johns-Manville Co. It endures expansion and contraction stresses without disintegrating or crumbling. At furnace temperatures it is sufficiently resilient to allow for the difference between its coefficient of expansion and that of the brick. See Figs. 1 and 2.

This product is said to have another useful application. Where boilers are hard pushed, holes are often burned through the arches. For quick repairs in this emergency a wooden form is built under the holes in the arch, and these are filled with cement. A slow fire is started under the arch, which burns out the form. The cement vitrifies in place and will hold as long as the arch stands. By this means the boiler is off the line for but a short time. Holes up to 2 ft. in diameter have been satisfactorily plugged in this manner.

The Lehigh & Wilkes-Barre Coal Co. often blows a boiler down on Saturday afternoon, draws the fire and plasters up the side walls of the boiler along the fire line with this material. By Sunday morning the furnace is ready and fires can be started for the raising of steam. This saves tearing out the old firebrick and replacing it with new, which possibly would hold the boiler off the line for several days. Such a repair is not only lower in cost but more rapid than one where the fused or deformed brick are replaced.

Importance of Providing Tight Baffles

Tight baffles are indispensable to the attainment of maximum efficiency with water-tube boilers. By their use more heat can be abstracted from the gases as they move through the various boiler passes to the flue. Their main purpose is to cause the heated gases to sweep over a maximum area of tube surface and to guide them so that they impinge upon the tubes in the most effective manner. When there are no baffles or when the baffles are imperfect and leaky the gases naturally take the path of least resistance and short-circuit to the stack. Where tiles are used for cross-baffling they are sprung into place between the tubes, and it is practically impossible to keep the joints between them tight because the unequal expansion and contraction of the tubes force the joints apart. The tile blocks thus work loose and if they become broken, fall out. Inclined cross baffle walls of tile are even more difficult to maintain.

For this reason monolithic baffle walls composed of cement, cast in forms, are advantageous. They are

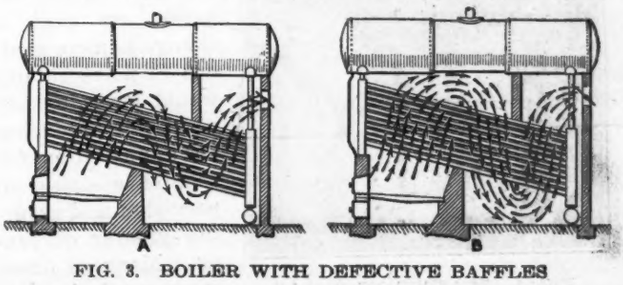


FIG. 3. BOILER WITH DEFECTIVE BAFFLES

In the first some of the heated gases take a short course and therefore part of the available heat goes up the stack. In the second every portion of the heated gas has to pass three times over the tubes and all the absorbable heat is taken up by the water.

more durable and efficient and will not readily break away. The Johns-Manville Co., Inc., recommends a 4-in. wall. The wooden forms may set vertically or slightly inclined, as desired. The high temperature cement is mixed to the proper consistency, poured and tamped. After it is partly dried a fire is started, and the wooden forms are burned out.

A different construction is recommended by the Betson Plastic Fire Brick Co. On one side of the baffle an ordinary cast-iron baffle plate is placed. This serves as one side of a form for retaining the cement. On the other side wooden slats are latticed between the tubes at a distance from the plate equal to the intended thickness of the baffle wall. Then to fill the space plastic material is poked down diagonally between the tubes.

The furnace should be fired up before the monolithic baffle wall has completely set, so that it can give somewhat. By the time the boiler furnace has acquired a capacity temperature the baffle wall has set solid, hugging the tubes. In this way internal stresses are avoided. Like other refractories this plaster is less able to withstand strain at high than at low temperatures, consequently an excellent point is gained by arranging for an absence of strain when the furnace is at its maximum heat. When the temperature decreases, the strength of the baffle wall increases. Thus, despite the difference in the coefficients of expansion of the tubes and the cement, neither rupture nor distortion occurs. The walls fit snugly around the tubes even at the lower temperatures.

Facing the Furnace with Refractory Cement

Not only can Betson plastic firebrick be used for the construction of baffle walls but it can be introduced to replace firebrick at any point in the furnace. It is claimed that its coefficient of expansion is equal to that of brick. The lining is laid as a monolith, and so there are no joints where disintegration can occur. The material is pounded into place with a mallet and then troweled. It is not applied as a thin plaster but in such quantity that the layer is equal in thickness to a brick course. After laying, the lining is subjected to a low fire for a few hours to draw the moisture; the furnace may then be fired as usual. The merits claimed for this refractory are that it is more permanent than firebrick arches and that there are no seams to weaken the walls, that it is unusually well suited for use with overhanging baffles, that it is easily applied and that the material can be used successfully for the quick repair of furnace linings. In Figs. 4 and 5 may be seen walls of this material in process of erection.

These are some of the many ways in which savings can be made in the boiler house. Where the old-type tile baffles are used, a change to more modern construction would lower upkeep costs by reducing interruptions for repairs, lessening supervision and assuring greater efficiency. Many of these recommendations are not available with boilers of the older types, and such equipment should certainly be replaced if used for any other purpose than as standbys. During the present shutdown the opportunity for such replacement is offered and it should not be neglected. No economy is more expensive than retaining antiquated equipment, which will indeed raise steam, but at great expense in coal, labor, maintenance and lost operating time.

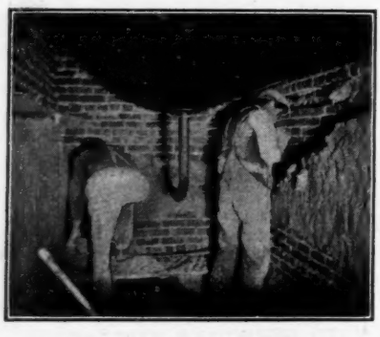


FIG. 4. PLASTERING WALLS

One man is plastering a side wall and one the back wall. The plaster is pounded into all holes.

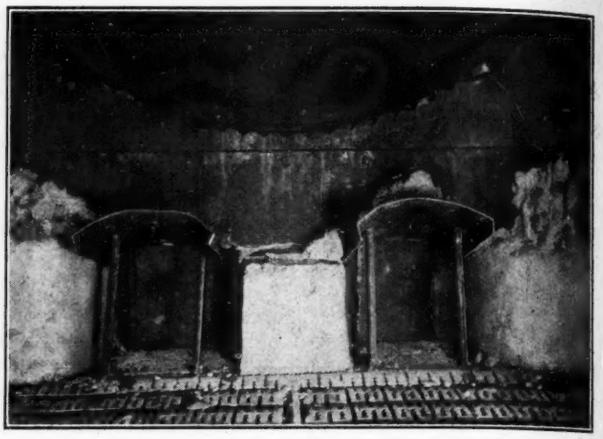


FIG. 5. PLASTERING FRONT WALL OF BOILER WITH PLASTIC "FIREBRICK"

The corner and center blocks are finished. Note the door forms in place ready for completion of the work of plastering.

Where this equipment cannot be replaced for lack of funds, however, the joints may be pointed with some suitable material and both joints and brick covered with paint, thus materially reducing the leakage of air through the pores and cracks of the brick and jointing material. By plastering the interior with some of the firebrick substitutes just described, the walls, where in bad condition, may be further tightened and made more permanent. Most of the air that leaks into a boiler through the walls, not being under control, lowers the temperature of the flue gases without in any way aiding in combustion. The more air passing up the furnace stack at 600 deg. F. or thereabout, the more heat is being wasted to the atmosphere.

Carbon-Dioxide Bombs Buried in Coal Pile Extinguish Fire When Plug Fuses

WALTER L. WEDGER, chemist of the explosives and inflammables division of the Massachusetts Department of Public Safety, describes the use of bombs and tetrachloride of carbon in the extinguishment of fires in stored coal, says *National Safety News*.

Several devices are in use to extinguish fires at the bottom of huge piles of coal. Professor Lewis describes the following ingenious method: Steel bombs filled with liquid carbon dioxide are placed in various parts of the pile. They are provided with a fusible plug which melts at 93 deg. C. or about 200 deg. F. If the temperature of the coal pile rises to the degree at which ignition probably would take place, the plug melts and the carbon dioxide escapes, cooling the coal and extinguishing the fire.

Long pipes often are driven down in the coal where the smoke appears thickest and through them carbon tetrachloride is poured. On striking the fire this liquid forms a vapor five times heavier than air, which sinks downward, extinguishing the fire by depriving it of the oxygen necessary to maintain combustion.

COAL AGE

C. E. LESHER, Editor

Volume 21 MAY 18, 1922 Number 20

Saving of Ventilation Power Costs

AS THE Kathleen mine is by no means an old one and the coal is thick, its charges for ventilation, given in this issue in an article contributed by Eugene McAuliffe, are by no means unduly high, whereas the charges for haulage are quite a little above normal, as heavy grades are encountered, making transportation costs disproportionately heavy and so lowering by that fact the percentage rate of the power costs of ventilation. Yet the ventilation charge was as much as 15.7 per cent in the coal year 1921-22. Probably at Kathleen the percentage could not be reduced greatly except by somewhat steadier work, but certain it is that at many other mines where it is even higher it certainly could be.

The older forms of brattice are a delusion and a snare. Even if a perfectly tight brattice could be built of double boards or double boards and battens, with the use of a little mud frequently replaced, it would not be tight, for the leakage round the edges would be found to be considerable. Suppose in a single mine there are four hundred brattices, the coal being six feet thick and the crosscuts eight feet wide, then the total peripheral length of these brattices would be more than eleven thousand feet.

If the crevice along that periphery were only one-sixteenth of an inch wide, the area of the openings thus made would be a little less than sixty square feet, which would be equivalent to a crosscut six feet high and ten feet wide. Of course, the resistance of such crevices, seeing they are narrow and often quite crooked, would be far greater than would be afforded by the opening indicated. Still it is easy to see that the loss is of great importance and a study of it will do much to explain why a large proportion of the air in the main airways entirely fails to reach the face.

For this reason a material should be used for brattice fitting, and for brattice building also, that is more permanent than kneaded fireclay. A substance with so little cohesiveness and with so much contractility is sure to crack even in the dampest of mines. A two-inch brattice, even if tight at the sides, may not hold back the air, for small threadlike currents can leak through the crevices in the rock at the top, the coal at the sides and the clay in the bottom. By the use of a cement brattice not only is a tight joint secured between the brattice and the ribs but the rock, coal and bottom can be made tight by cementing all three for a few inches or a foot beyond the face of the brattice.

This has become a common practice in metal mines and it is worthy of acceptance in coal workings, where the length of the roadways makes the aggregate leakage greater than it is in metal mines. The adoption of this plan should greatly reduce those many but important losses which are so small at any one given point that they cannot be found by a flame. The flame test is by no means infallible. Many a brattice which the flame of an open oil torch would attest tight will allow appreciable quantities of air to pass through it and past it. It is needless to point out that a gunite or cement stopping will be more effective than one which is built of boards or brick.

If a brattice is put at both ends of each crosscut a still better stopping will be obtained, especially where the water gage between the airways thus isolated is considerable. Where the old brattice is behind a pile of rock a new brattice built in front of or behind it will save the removal of the rock and give increased protection against leakage.

Engineers are not any too well versed as to the speeds with which the air is made to travel airways of different kinds. This should be a matter of careful investigation. For each kind of airway the velocity should be not more than a certain percentage greater or less than the velocity in the airshaft. In overcasts the velocity should be low, though in most cases the air is caused to move more rapidly there than anywhere else. When consideration is given to the crooked course of the air in passing over an overcast and to the increase of friction due to changes in the form of the passageway, it will be realized that ample dimensions are most necessary at this point. Yet at overcasts the cross-section usually is smaller than anywhere in the split thus ventilated. No careful study of the air velocities in coal mines has ever been made. Shafts are designed large enough to take care of transportation, water pipes, stairways and all the other desiderata, but the air usually is expected to get up or down in some manner or other, opposed in the upcasts often by streams of falling water. This is not as it should be.

In many cases it would pay to line shafts with concrete, not alone because they would be more permanent but because they would pass more air. Even in the mine where high-speed currents are encountered it often would pay to concrete passageways instead of timbering them and even to cut straighter roadways, so that the air would not be eddying past difficult turns. The analysis of costs of power as given by Mr. McAuliffe in this issue should be duly studied as are labor costs, for there is no question but that some could be greatly lightened as a result of such studies. Not the least of such inquiries would be one relating to ventilation.

Choice of Machinery

IN THE choice of machinery none but those units which may be expected to function with a minimum of breakdowns or failures should be selected. Machinery should be chosen that does not occasion constant worriment and uncertainty and will do the work with a broad margin over and above what is desired from it without being so cumbrous as to waste power in operation. It is well to have plenty of power, but if it be obtained through the use of larger units than will be needed in slack or idle times the mere work of turning them over will be excessively costly. Expenditures, however, in the purchase of machinery that functions completely always is profitable. Ample safety, ample protection against overheating, proper regulation and durable wiring may not be advisedly overlooked.

Some would say that a good machine should last indefinitely, but machinery is bettered year by year and the method of operation may change. Speeds of operation increase, new forms of regulation are introduced and no machine can be permanently the best of its kind. So a machine is built for time, not eternity. But if it

be not up to date and fully functioning at the start what hope is there that ten years hence it will be anywhere in the race? There is no reason, surely, for buying and installing what is from the start inferior to that which the industry regards as the best to date. A better indeed may come later, but when it does it will be further ahead of the older type of machine than it is of the one which represents the foremost model of the present day.

The reason, then, why good workmanship and material are recommended is not because such a machine will last indefinitely but because in the decade or more that it is kept running it will function with constant satisfaction. The superintendent has enough difficulties of operation at best, what with labor problems, marketing difficulties, fires, floods, explosions, roof falls and irregularities in coal thickness. Consequently it is well for him to have his mechanical problems settled rightly from the start. Too many managers and superintendents are handicapped by the purchase of improper machinery. The uncertainty of these makeshifts is sure to involve their owners year by year thereafter in constant difficulty.

Light That Blinds, But Not Illuminates

FOR many years automobile owners sought to equip themselves with brighter and ever brighter lights. The wayfarer traveling along the road was blinded by the brilliance of the lamps and could see nothing—neither what was along the line of the beam nor what lay out of its range. Nowadays a more diffused and mellower light is preferred, and legislation has required it. The light is less but the public can see better.

When will we learn that a diffused light in our industrial affairs would be better for the public than a glaring spotlight on certain industries and gross darkness on the others? Good roads are as necessary as railroads, are as much a part of our life as coal. The industry of making good roads, how is it functioning? We have seen no records other than those in Iowa.

There, H. K. Davis, chief inspector, Iowa Highway Commission, Ames, Iowa, has made a careful investigation into the time during which work on contracts lasts, and in the *Engineering News-Record* of May 4 says that the average length of time used per concreting road outfit was 114.3 calendar days. When Sundays and legal holidays were omitted, however, this average shrunk to 96.1 calendar days.

"Eliminating all rainy days and other stops," says Mr. Davis, "leaves an average of 74.1 days per outfit on which concrete was actually laid during the season. Not all of these were full days, as many of them show only short runs, rain or breakdowns stopping the work for the remainder of the day. To the highway commission and the contractors of Iowa it was a distinct surprise to find that all the concrete laid in a season's work could have been concentrated in two and one-half months of steady work if only the causes for delay could have been eliminated." He adds that the average showed that only 54.7 full days were worked, a day being reckoned full that had no delay of more than 45 minutes.

Doubtless road making is in a degree no more the life work of a laboring man than is snow shoveling, and it would not be fair to overlook that some of these concrete men may find work in other parts of road making, in farming, in lumbering and other odd jobs throughout the year, but men who take part in such a highly seasonal occupation and one with which the weather so severely interferes must necessarily have an immense amount of lost time.

So far, the public has not insisted that this class of work "function well." Indeed, it never has decided how badly an industry must function to absolve itself entirely of the charge of functioning badly. All we know is that if any industry works only two-thirds of the year it is in line for the record as the worst functioning industry, but if it works only 74 days in the year it can entirely escape such an imputation, for it comes under the head of a casual industry, to which everything is forgiven. It is one of those ne'er-do-wells that a busy world finds no time to censure. An industry that runs as much as two-thirds time is an established citizen that should be 100 per cent perfect because the public feels it ought to be able to rely on it. It is a fit subject for scandal and for gossip. Of those who do nothing, expect nothing. Of those who do well, expect everything.

Beware of the light that illuminates only a part of the road. Paraphrasing Kipling, "How shall they know of coal mines who only coal mines know?" If we do not study all the industries we cannot form a well-balanced judgment of any one. Hence it is truly comforting to know that, led by Mr. Hoover, who penned the indictment against the coal business as the "worst functioning industry," the construction men are somewhat belatedly assembling and organizing to see if there is not some way by which they can make their operating time more closely approach the length of the calendar year.

Now We Learn About Costs

AT NO time do depreciation costs show up more plainly than when the mines are idle. During such periods the repairs and renewals which have to be made not only cannot be taken from profits but cannot even be partly hidden under the disguise of costs of operation. They are often the only expenditures that a mine makes outside of those involved in ventilation and drainage. And how they do irk.

It is often said that the idle house runs down quicker than one that is occupied. This is partly true, for the proprietor is rarely willing to spend the necessary upkeep money or to furnish the superintendence that will make decay less rapid. It is also partly untrue. Much of the difficulty arises from the fact that we more clearly visualize the repairs of an idle house and its depreciation with the interest and taxation charges as the only tangible evidences of proprietorship. The expense is absolutely all we see.

Consequently the day when this is borne home on us in force is the time when we hunt around for a remedy. We look for pipes that will not corrode, timber sets that will not rot, roadways that will not cave, pumps that will not break down, valves that will not leak, waterways that will save pumping, methods of working where the face will not be buried and many other desirable economies. These sobering periods should surely make us spend money to save money. During them we learn that the frenzied periods never last but are always likely to be followed by longer periods of low profit or of loss, and we consider business from the point of view of investing money to save money rather than from that of investing money to make more.

Problems of Operating Men

Edited by James T. Beard

Cost of Production Affected by Incompetence of Many Mine Foremen

Many Foremen Unfitted for the Position They Hold—Superintendent to Blame If Mine Is Ruined—More Thorough and Frequent Inspection of Mine Required—Instances of Mismanagement Cited

A SHORT time ago reference was made, in an interesting letter by James Thompson, *Coal Age*, Feb. 23, p. 333, to the manner in which the cost of producing coal is largely affected by the vagaries of the foreman in charge of the work.

The letter called attention to a worth-while subject for discussion; and, while fully agreeing with all that was said, I wish to add a few thoughts suggested by the reading, in the hope of impressing on the minds of all of us what it means to employ competent foremen and superintendents in coal mining.

In my way of thinking, foremen compare favorably with housekeepers. Some are good, others ordinary, while a stray one here and there has nothing that would recommend him for taking charge of any kind of work, much less that of coal mining.

Why Do Incompetent Foremen Aspire for the Position

With regard to this last type of foreman, the wonder of it all is that they aspire at all to the position. It is a puzzle to know by what means they are able to hold the job. Too often it happens that the man is retained until things actually go to pieces in the mine.

When that is the case it is because there is not sufficiently close relations existing between affairs on the surface and underground. The way to overcome this condition is to maintain a regular system of mine inspection and employ some competent and disinterested party who will report the true conditions of affairs to the management or the owners of the property.

I fully agree with the remarks of R. J. Pickett, writing on the subject "Do Foremen Sleep on the Job?" in the issue Apr. 27, p. 700. Mr. Pickett places the blame for the ruination of a mine squarely on the shoulders of the mine superintendent.

With that writer I believe that, ordinarily, the superintendent is to blame for a mine being hogged out by an incompetent foreman in charge. It takes time to completely ruin a coal property, and when that happens it is evident that the superintendent himself is either an unpractical man or has failed in his official duties, by not making thorough and frequent visits, going into the mine and closely inspecting the workings.

Duty of Superintendent To Make Frequent Visits in the Mine

A practical mine superintendent will go through his mine at least once a week and familiarize himself with every detail of the work in progress. By so doing he would observe all questionable practices in the economic mining of the coal. It is the province of the superintendent to oversee and correct whatever is wrong, after due consultation with his foreman.

We are all, more or less, prone to make mistakes, but we fail when allowing ourselves to make the same mistake twice. I recall, now, one operation that had, for a long time a continued run of bad luck, because the superintendent seldom went into the mine, claiming that he had hired a foreman to look after that work.

Shortly, the time arrived when it was a real battle to get the coal out. Among other bad practices, it was the custom in that mine to quit a room when it encountered a slightly adverse condition. The miner driving the place would be given another room and so the work went on leaving behind coal that could not be recovered later, except at great expense.

In robbing, pillars were drawn back by taking long slabs off the rib, which often made it necessary to leave many end stumps. When the entry pillar was reached, instead of stopping the man, the boss would say, "Bill, work there another day, as I have no other place ready for you."

Another and still another day would follow, the man getting easy coal by slabbing the entry pillars, until they became too thin to furnish the needed support on the entries. This sort of work gave no end of trouble on the roads and greatly increased the cost of operation.

Another foreman took charge, and, for a time, succeeded in increasing the daily tonnage, which pleased the management. But, all at once, things again went to pieces when it was found that the new foreman had pulled the standing pillars under a wide valley that was often flooded during wet seasons, which was the reason why these pillars had been left.

Let me say in closing, the best insurance for the uniform production of coal is a frequent rigid inspection of the mine, by a capable man who is familiar with conditions in that particular field.

GEORGE EDWARDS.

Pikeville, Ky.

Good Mine-Car Hitchings Assist Production of Coal

Different kinds of mine-car hitchings in use — Couplings adapted to different styles of equipment — Effect of slack in hauling long trips of mine cars.

ONE of the important features in reducing the cost of operation and assisting to increase the production of coal is the selection of a suitable form of mine-car hitching. This subject was discussed by George Edwards, *Coal Age*, Feb. 16, p. 292, who drew attention to the need of adopting a good form of coupling on mine cars, in the interests of safety.

There is no greater annoyance, in the operation of a mine, than to have the day's run suddenly interrupted by a wreck occurring on the main haulage road. This is especially provoking when it is considered that the thing might have been avoided had a little more attention been given to providing a form of car hitching better adapted to the conditions existing in the mine.

Different Forms of Couplings for Varying Conditions

That there are numerous kinds of these hitchings now made and in use at the mines, today, is well known. Practically all of these have advantages and disadvantages that make them more or less suited to different conditions of haulage. Naturally, the best form of hitching to use in any particular case must be determined by the system or type of haulage employed and the kind of equipment in use.

Because one form of coupling has been found to give satisfaction at one mine, there is no reason to conclude that such coupling is the best form to adopt. A careful study must be made of the conditions that make that kind of coupling a success. If these conditions are identical with those in question one may rightly conclude to adopt the same form of hitching.

In the letter to which I have referred, Mr. Edwards expresses a preference for the coupling having three small links and two clevises. From this I am

led to believe that he is using cars equipped with two bumpers, which is the style of car that I consider requires such a hitching.

On the other hand, cars equipped with but one bumper, or with the half-moon style of bumper, I believe are better coupled with a single link and two pins. In practice, I have found this coupling superior to any other form of car hitching. Experience teaches, however, that the cars themselves must be kept in good condition and the drawbars in proper shape, if trouble is to be avoided.

One feature that must not be overlooked is the amount of slack it is safe to permit in hauling a long trip of cars. This may vary from three to six inches between cars. In any case, the allowable amount of slack must be regulated by the kind of haulage performed.

It is astonishing, at times, to observe the amount of coal that has fallen off cars in transit, owing to the cars having too much slack when hauled over roads of variable grades.

Benefit Results from Changing Style of Coupling in Use

Just now I recall one instance where we exchanged the three-link coupling attached to the cars by two clevises, for a coupling consisting of a single link and two pins. The result was that the motorman could handle longer trips, without losing a third of the coal that formerly fell from the cars in transit.

While admitting that the three-link coupling has certain advantages that recommend its use, owing to recent improvements in that style of hitching, it can hardly be denied that much time is often lost by reason of the pins falling out from the clevises when the latter are dragged along the haulage road. This is liable to happen if the hanger provided is loose or someone has failed to hang up the coupling before starting the trip.

Finally, reference has been made to men being frequently crippled in the use of a single-link coupling. That, however, is largely due to their own carelessness and, I believe, is apt to occur whatever form of coupling is used. In gathering-motor haulage, I much prefer the half-moon bumper coupled with a single link and two pins, which I believe gives better satisfaction than any other form of hitching made.

———, Ky. MOTORMAN.

Natural-Born Miners

Long training and association make natural born miners — Economy in production of coal requires natural mining ability — Prejudice of foreign miners not a factor.

IS IT true, as stated in the letter of James F. Gamille, *Coal Age*, Feb. 23, p. 333, that "one of the great drawbacks in American mining, in respect to the adoption of economical methods, is the large number of English, Scotch, and Welsh miners in charge of the work in our mines?"

It puzzles me to know why this correspondent did not include Irishmen, in his category of miners who are drawbacks to progress in American mining. It may have been fear of the proverbial pugnacity of the Irishman that caused his exclusion from the list of undesirables.

Perhaps, our friend has been told the story of the Dutchman who was heard to remark "My father, brother and myself met a drunken Irishman; and, in the altercation that followed, we nearly succeeded in licking the man, but all we had was a butcher's cleaver."

Foreign Mine Officials Not Men of One Idea as Claimed

In my opinion, the correspondent displays more narrowmindedness, in his statement, than he alleges is possessed by the average English, Scotch and Welsh miner, whom he charges as being "largely men of one idea," adding, "It is difficult to impress them with the advantage of a new plan."

Personally, I have had no experience in Pennsylvania but, in the Rocky Mountain region, have found many brilliant coal-mining men of British birth. Rarely have I heard the expression "It was never done that way in the old country."

Though it is often claimed Englishmen are slow to perceive a joke, they are not as dumb as the new arrival in this county (we will not state his nationality), who calmly took as a joke the most serious statement.

Sitting by the open window of a train, one day, the man was warned by the conductor, who shouted, "Lookout, we are coming to a tunnel." Instantly, the man stuck his head out of the window, only to have his cap brushed off by the close proximity of the tunnel walls. Jumping back he exclaimed, "By Jove, this is a funny country; they say 'Look out' when they mean, 'look in.'"

Long Training and Association Makes for Efficiency

Seriously, it would seem to an unbiased observer, that the long training and association of foreign-born miners who come to this country must make more efficient and competent mine workers than many men who go into the mines, either because of the high wages it offers or by reason of their inability to find other work.

Surely it is not claimed that farm laborers, tramps and other wanderers in search of work can be classed with men born in mining countries and trained, from childhood, in that occupation. They are natural-born miners. As well might we expect to breed race horses from Indian ponies, in one generation.

Practical mining men know that economy in the production of coal requires natural mining ability. Observation in this part of the country enables me to say that, out of twenty men other than British extraction, at least fifteen are attracted to the work by the high wages paid.

Now, contrast this attitude with that of the average foreign-born miner, who has no aspiration that would take him out of the mine where he expects to spend the remainder of his days. If he *has* prejudice in favor of methods and ways with which he is familiar, this is not a factor to be considered as a "great drawback" to the economical production of coal.

To offset this prejudice there is the inborn ambition to follow, with close study, the coal-mining game and to make his work most effective. I offer this as the reason for the large proportion of English, Scotch and Welsh mine officials who have been advanced to positions of responsibility in American mines.

Needless to say, I am a British-born American citizen, simply because I can see that the American form of Government is better than that of Great Britain; and the opportunities afforded my children are greater in this country where large areas yet remain undeveloped.

Oak Creek, Colo. THOMAS ALLEN.
The Moffat Mines.

Economy in Coal Production

Concentration of work reduces cost of operation — Less time lost by foremen traveling from place to place — Better supervision of work and fewer accidents — Good track arrangements avoid congestion.

HAVING always a practical regard for the ideas of others, it has been my custom to observe closely the ways and means used in different mines to reduce the cost of production. Experience in over two score of coal mines where I have worked has convinced me that there is one chief element in producing coal at a minimum cost.

In almost every mine one enters, the close observer is impressed with the great lack of concentration of work. Naturally, there is a correspondingly high maintenance cost that could have been avoided and much of which it is possible to eliminate at the present stage of the game.

No extended argument is required to prove that where work is concentrated there results a great saving in many ways. For example, there are fewer roads and travelingways to maintain in a mine. The foreman and his assistants lose less time, in going from place to place; there is a far better supervision of the work and fewer men are required for that purpose.

Fewer Accidents Happen

No one will deny that, under these conditions, fewer accidents will happen at the working faces and on the roads. There is less liability of cars being derailed and wrecked, because more attention is given to keeping both the track and cars in good condition. Moreover, a less number of cars will suffice to operate the mine.

When a wreck occurs on a road in an isolated portion of the mine there is bound to be much delay as little or

nothing can be done until word is sent to the mine foreman or one of his assistants and he reaches the place and takes charge of the work of clearing and repairing the track.

Consolidating the Work Gives Increased Tonnage

Not long ago, I tried out a scheme, in a mine of which I had charge, with the result that a larger tonnage was produced at a less cost and better supervision given to the work. In that case, there were 25 less cars required to run the mine and the arrangement afforded less congested sidetracks.

In the average mine, having an output of from 1,200 to 1,500 tons of coal per day, there are from five to six sidetracks, each holding, say from 35 to 40 cars, waiting for drivers to haul them out of the mine, or take them into the working places.

In most cases, it is possible to consolidate two or more of these sidetracks and when this can be done to advantage, it will effect a considerable saving in the cost of operation. This, of course, will depend on the conditions in the mine. In any case, the arrangement should provide automatic switches that will close with a springpole as the cars pass out onto the main track.

Under favorable conditions, using cars holding 3,000 lb. of coal, where the average haul does not exceed one-quarter mile, round trip, 9 mules should handle 750 tons of coal in eight hours. Under the same favorable conditions, this might represent the output of 90 men working in a single section.

In closing, let me say a close study must be made of the conditions in the seam and the work planned so as to afford the greatest concentration of men. The haulage arrangements and sidetracks must be such as to avoid congestion and delay.

Central City, Ky. Ostel Bullock.

CORRECTION

By mistake the inquiry entitled "Blasting Machine-Mined Coal," which appeared in *Coal Age*, Mar. 30, p. 538, was signed "Superintendent," instead of "Tracklayer," as it should have been, coming as it did from one of the track employees of the Colorado Fuel & Iron Co., at Berwind, Colo.

Inquiries Of General Interest

Mine Foremen's Qualifications Required in Different Coal-Producing States

Many States Have No Law Requiring Certification of Mine Foremen —Chief Requirements Relate to Citizenship, Age, Character and Experience of Candidate—Some Companies Examine Their Own Men

CONTEMPLATING visiting the States in the near future, with a view to locating in one of the coal-mining districts wherever the conditions appear most favorable, I shall very much appreciate seeing, in the columns of *Coal Age*, a brief outline of the qualifications required of candidates for mine foremanship, under the different state mining laws. I understand there is a considerable difference in this respect, some of the states being more strict in their requirements than others. Candidate.

Nanaimo, B. C., Canada.

The laws of many of the coal-producing states make but slight mention of any requirements relating to the operation of the coal mines in those states. Almost 50 per cent of the coal states practically ignore the matter in their codes.

The states having the most complete coal-mining laws, in the order of their importance, are the following: Pennsylvania, Illinois, Colorado, Alabama, West Virginia, Iowa, Tennessee, Ohio, Indiana and Kentucky. The states of Missouri, Kansas, Oklahoma, Utah, California, Washington and Wyoming, with a few others, have laws regulating, to a greater or less degree, the mining of coal.

The chief requirements of coal-mining laws relate to citizenship, age, character and experience of candidates for the positions of mine foreman and assistant foreman and fireboss. It is only possible to enumerate these requirements as specified in some of the states where the laws are more specific. The requirements of candidates seeking the position of mine foreman in the principal coal states are the following:

Pennsylvania—The anthracite mining law requires a candidate for the position of mine foreman to pass a satisfactory examination before a state mining board and furnish satisfactory evidence that he has had at least five years' practical experience, as a miner, is capable and of good habits.

The bituminous mining law of this state requires the candidates for the position of mine foremen to be citizens of the United States, of good moral character and known temperate habits, at least 23 years of age and to have had at least five years' practical experience, after 16 years of age, as miners, mining engineers or men of general work inside of the mines of Pennsylvania. Bituminous mine foremen's certificates are of two grades; the first-grade certificate makes the holder eligible to appointment in a gaseous mine, while the second-grade certificate limits the appointment to non-gaseous mines. Both of these certificates require the candidate to have received 80 per cent in his examination.

The amended Pennsylvania law, both anthracite and bituminous, legalizes the appointment to this position of uncertified men who, in the judgment of the operator, are equally competent with the holder of a certificate. The law also provides for the granting of service certificates.

Illinois—The law requires a candidate for the position of mine manager (foreman) to be a citizen of the United States, at least 24 years of age, with at least four years' practical mining experience, a man of good repute and temperate habits. The candidate must pass a satisfactory examination before a duly appointed state examining board. The law provides for first-class and second-class mine managers' certificates, the latter limiting the holder of such certificate to service in mines employing not more than ten men.

Colorado—The law requires a candidate for the position of mine foreman to pass an examination before a duly authorized state examining board and to have had at least five years experience in coal mines in the United States, and to have worked underground, in coal mines in Colorado, for at least six months immediately prior to the examination.

Alabama—The law requires applicants for first-class mine foremen's certificates to be at least 23 years of age, and to have had at least five years' practical experience, three years of which shall have been spent in coal mines after the applicant has attained the age of 15 years, serving as mine worker or in an official capacity, at or inside the mine. The applicant must be a citizen of the United States and furnish a certificate of good moral character and known temperate habits, signed by ten reputable citizens where he resides. Certificates of the first class relate to service in mines generating gas, while second-class certificates relate to mines not generating explosive gas.

West Virginia—The law requires a mine foreman to hold a certificate of competency granted him by a state mining board upon passing a satisfactory examination before said board. The candidate must be a citizen or resident of the State of West Virginia and have had at least five years' experience in the working, ventilation and drainage of coal mines.

Iowa—The law provides for the examination and certification of candidates for the position of mine foreman and specifies the candidate must pass a satisfactory examination before the state examining board, as to his qualifications and fitness. The law provides for the granting of service certificates to candidates producing satisfactory evidence of four years' continuous and capable service as mine foreman.

Tennessee—The law requires the applicant for certificate to act as mine foreman to be a citizen of the United States and to pass a satisfactory examination before a duly appointed state examining board and to give evidence of good conduct, honesty, capability and sobriety. In all mines generating gas or dust in dangerous quantities, the foreman must hold a class-A certificate.

Ohio—The Ohio mining law does not provide for the examination or certification of candidates for the position of mine foreman.

Indiana—The law authorizes the state mine inspector to hold examinations for certificates of service and competency at Brazil, Terre Haute, Washington and Evansville, in the state, and requires him to publish notice of the time and place when holding such examinations. Applicants for the position of mine foreman must be citizens of the United States.

Examination Questions Answered

Examination Foremen and Assistant Foremen, Fifteenth Anthracite District

(Hazleton, April 11-14, 1922)

QUESTION — *What duties does the mine law exact from the operator and the mine foreman?*

ANSWER—The duties are numerous. Briefly stated, they may be summarized as follows: To employ what assistant foremen are necessary to carry out the provisions of the law; to measure once a week and report to the mine inspector the air measurements taken, at the intake and discharge openings, and at the face of each gangway, and at the nearest crosscut to the face, in the inside and outside chambers of all headings where men are employed. The foreman is to have full charge of all matters relating to ventilation. He must examine all accessible parts of abandoned places, at least once a week, and see that the mine is examined each morning, if generating gas. Every working place must be examined each alternate day; and all slopes, shafts, roads and travelingways, signal apparatus and pillars, every day. The foreman must see that workmen are furnished with necessary timbers and instructed to make their places safe; prohibit persons from working unsafe places; regulate blasting in the mine; supervise the handling of cars, in rooms and on haulage roads; care for injured persons and report all accidents to the mine inspector, as required by law.

QUESTION — *What examinations of a mine are necessary according to law? By whom are these examinations to be made and how often?*

ANSWER—Besides the regular morning examination by the fireboss, in mines generating gas, the law requires the mine foreman or his assistant to visit and examine every working place in the mine, at least once each alternate day, while the men are at work in such places. The law also requires that the mine foreman, or some competent person designated by him, examine, at least once every day, all slopes, shafts, main roads, travelingways, signal apparatus, pillars and timbering and see that they are safe and in good working condition.

QUESTION — *What are the requirements of the mine law in regard to safety lamps? Also, what constitutes a good safety lamp? Give your reasons.*

ANSWER—The anthracite law forbids the use of any other light than that of a locked safety lamp, where there is danger of explosive gas existing in a place, or where the place is approaching another likely to contain an accumulation of gas. These lamps are to be the property of the owner or operator of the mine. All safety lamps in use must be examined and cared for by a competent person appointed for that work; each lamp to be securely locked before being taken from the lamphouse, unless permission is given by the mine foreman to use the lamp unlocked. No one but a duly authorized person may have in his possession a key or other contrivance for unlocking a safety lamp.

A good safety lamp, for work, is one in which the flame is completely isolated from the air surrounding the lamp, by means of a wire gauze chimney, all openings to the lamp being similarly protected. The air should enter the lamp at a point below the flame and the gauze chimney should be provided with a steel bonnet having suitable openings for the escape of the burnt air and gases. When such a lamp is properly examined and used by a competent person, it provides a reasonable protection against the ignition of gas by the lamp flame.

QUESTION—*What are the conditions that would render a safety lamp dangerous?*

ANSWER—If the lamp is imperfect, its gauze injured or clogged with dirt or soot, or the lamp is improperly handled by an incompetent person, exposed too long to a body of gas, exposed to a strong air current or blast of air, or allowed to fall, the lamp is no longer safe. A safety lamp is unsafe when improperly assembled or any part omitted.

QUESTION—*What action would you take should the gas flame in the lamp?*

ANSWER — When a lamp is surrounded by a body of explosive gas it will frequently happen that the lamp chimney will fill with flame. In that case, the person holding the lamp must make no quick movement but promptly and cautiously lower the lamp toward the floor, at the same time withdrawing quietly from the place, while shielding and smothering the lamp, if possible, under a coat or other garment, in an endeavor to extinguish the flame burning in the lamp. Any quick movement when a lamp flames is almost sure to force the flame through the gauze and ignite the gas-charged air surrounding the lamp.

QUESTION — *What instruments are necessary to measure the air currents of a mine? How is the quantity of air passing ascertained?*

ANSWER—To measure the air current flowing in an airway there is required an anemometer, which consists of a delicate vane that is revolved by the force of the air acting on the inclined blades of the instrument. The number of revolutions made by the vane are recorded and read on a dial. A watch is necessary to determine the time the instrument is exposed to the current. Each revolution of the blades corresponds to one foot of air travel, and the reading of the dial gives the number of revolutions of the vane. If the instrument is exposed one minute, this reading will be the velocity of the air in feet per minute. A tape measure is required to measure the height and average width of the airway. The product of these dimensions, in feet, gives the sectional area of the airway, in square feet; and this multiplied by the velocity of the air just found gives the quantity of air passing, in cubic feet per minute.

In order to find the power on the air or the power producing circulation, a water gage is necessary. Each inch of water gage corresponds to a pressure of 5.2 lb. per sq.ft. Hence the water-gage reading, multiplied by 5.2, gives the unit pressure on the air. Finally, multiplying this unit pressure on the air by the quantity of air in circulation (cu.ft. per min.), gives the power on the air, in foot-pounds per minute. Again, dividing by 33,000 gives the horsepower on the air.

Reports Are at Odds on Centralization of Coal Buying for Government Needs

By Paul Wooton
Washington Correspondent of *Coal Age*

TWO reports have been submitted to Colonel H. C. Smither, chief co-ordinator of the Bureau of the Budget, from the sub-committee on Co-ordination of Government Coal Purchases. In one of the reports it is recommended that a central coal purchasing committee be created as a permanent sub-committee of the Federal Purchasing Board. It is to be composed of a representative from the Navy Department, the War Department, the Bureau of Mines, the U. S. Shipping Board, and the Panama Canal. The suggested duties of the proposed central coal purchasing committee will be as follows:

To formulate and put in effect general regulations governing the policies and methods to be followed in the purchase of coal for all government requirements.

To oversee and co-ordinate the work of government coal purchasing agencies in preparing specifications and sending out requests for bids, and in making and awarding contracts for their coal supplies, whether for short-term or long-term periods.

To keep informed regarding all government coal requirements, the use of different kinds and grades of coal, plant equipment, coal-handling facilities, storage facilities and transportation, sampling, analyses and tests, as well as all other matters affecting government coal purchases.

To keep informed and closely in touch with market prices of coal, general conditions in the industry, transportation facilities and conditions, labor conditions, new coal-mining developments and new developments in the use of fuels, new fuels and methods of sampling and analysis, such information to be supplied to the different government coal-purchasing agencies.

To represent the government in all dealings with the coal industry involving the policies and methods of the government in making coal purchases to meet its requirements.

Those advocating the establishment of the central committee do not expect it to take over all of the work of the different coal-purchasing agencies of the government. These agencies would continue as heretofore to make their own purchases but assisted by the central committee, which would have a broader view of the government's coal requirements and which would have at hand exhaustive information regarding prices and market conditions. This would tend to effect, its proponents believe, a co-ordination of government coal-purchase activities in such a way as to result in greater economy and efficiency.

Those subscribing to the other report believe centralized purchase by one agency is uneconomical and unworkable. The requirements of the various government departments are so different that, it is contended, no one office could buy satisfactorily for all departments. It is argued that there are the same reasons for having a purchasing office in each department as there are for having separate government departments themselves. The point is made that a central coal-purchasing committee presumably would issue regulations governing the purchase of coal by the several departments. This, it is feared, would have the effect of transferring control of purchases from the individual departments to the central committee. Those favoring this report believe it would be very unwise to take away final control of coal purchases from the department or establishment which uses the coal and pays for it and which is held responsible for the expenditure of its own funds.

The plan for federal co-ordination in the procurement and supply of coal has been outlined as follows by Colonel Smither:

1. *Overhaul of Specifications.*—This to be handled by Specifications Board and not primarily for the purpose of standardization but to see that each activity buys the most economical coal for its purpose at its location. The following conditions stand in the way of flat standardization of specifications:
(a) Source of supply material rather than artificial. Coal must be taken (and consumed) by someone as it is found; it is not made to order.
(b) Cost of transportation is as big an element as the cost of the coal itself.
(c) Difficulty of reliable inspection.
(d) Great variety of grades.
(e) Lack of uniformity in mines.
(f) Great variety of firing conditions.
2. *Standardization of Methods of Purchase.*—Fully covered by report of subcommittee.
3. *Amount and Distribution of Stock.*
(a) *For Primary (Departmental purposes).*—This is a matter of departmental discretion, except where obviously exercised in error. Any departmental requirement must be determining, but where alternatives are permissible, the interests of the government as a whole should be considered.
(b) *Availability for Federal Purposes.*—What are the possible interests of the government as a whole as distinct from departmental interests. Interchangeability of supply in case of emergency, such as war, strikes, etc. Interchangeability of supply to aid in tiding over periods of high prices. This presupposes the existence of some competent market authority to decide when the government shall buy and when not.
What can be done to safeguard these federal interests without jeopardizing departmental interests. Have a clearing house for information as to stocks on hand. Have a medium by which one department in need can seek aid from another. Have one competent, reliable, responsible central authority on coal-market conditions to do the guessing for the whole government. See that he gets the benefit of all advance or secret information regarding mining, transportation and other economical and commercial conditions affecting the markets.

Freight-Car Loadings Increase 44,198; 12,187 More Coal Cars Loaded

CARS loaded with revenue freight during the week ended April 29 totaled 758,286, compared with 714,088 during the previous week, or an increase of 44,198. This was the largest number of cars loaded during any one week in April and was an increase of 37,202 over the corresponding week in 1921, but a reduction of 42,674 compared with the corresponding week in 1920.

Coal loadings totaled 75,632 cars, 12,187 more than were loaded during the previous week and the largest number loaded during any one week since the coal strike began. This was, however, 68,228 below the corresponding week last year and 93,086 under the total for the same week in 1920. Coke showed an increase over the week before of 343 cars, which brought the total to 7,952 cars. This was 3,175 more than were loaded during the same week last year, but 2,900 below the year before.

Freight cars idle because of business conditions totaled 529,658 cars on April 30, compared with 529,884 on April 23, or a decrease of 226 cars. Surplus coal cars totaled 235,077, an increase of 5,185 within a week, while an increase of 1,718 was reported for coke cars within that period, bringing the total to 5,387.

Tentative Program
OF THE
Fourteenth Annual Meeting
OF THE
INTERNATIONAL RAILWAY FUEL ASSOCIATION
Auditorium Hotel, Chicago, Illinois
May 22, 23, 24 and 25, 1922

Coal Features

Monday, May 22

Paper on Lignite Coal—Prof. E. J. Babcock, dean of the College of Engineering, University of North Dakota.

Tuesday, May 23

"Locomotive Fuel: The Life Blood of Transportation"—G. M. Basford, consulting engineer, Lima Locomotive Works.

Wednesday, May 24

"The Government and the Coal Industry"—T. H. Watkins, president, Pennsylvania Coal & Coke Corporation.
"The Various Items of Saving by Using a Better Quality of Coal"—Earl Cobb, president, Southwestern Coal Co.
"Assigned Cars for Railroad Fuel"—C. G. Hall, general manager, Walter Bledsoe & Co.
Report of Standing Committee on Storage Coal—H. H. Stoek, professor of mining engineering, University of Illinois.

Thursday, May 25

"The Relation of Overdevelopment of the Bituminous Coal Industry to Transportation"—C. E. Lesher, editor, *Coal Age*.
"Standard Form of Contract Covering Purchase of Railway Fuel Coal"—W. J. Tapp, fuel supervisor, Denver & Rio Grande Western Railroad Co.
"Idle Day Costs"—F. S. Peabody, chairman of the board, Peabody Coal Co.
NOTE—The National Coal Association will be in annual session at the Congress Hotel, Chicago, May 24 and 25.

Declares Coal Is Steadiest of All the Great Industries of the United States

SPEAKING at the 27th annual convention of the National Association of Manufacturers held in New York City, May 8, 9 and 10, J. D. A. Morrow, vice-president of the National Coal Association, said that the present struggle between the mine owners and mine workers is one of the elemental struggles in American industry, a part of the after-the-war readjustment.

Mr. Morrow's subject was "The Outlook for Coal." He told his hearers that the bituminous-coal industry is one of the basic economic factors in our industrial development—the rapid extension of our manufacturing enterprises has been based primarily upon cheap coals—that the United States has had the cheapest coal of any of the great manufacturing nations of the world, and that it still has the cheapest coal of any. He denied that the coal industry is a seasonal industry. It is the steadiest of all the great industries of the United States, he said. The iron and steel industry is more seasonal than coal; so is the cement industry.

"And let me tell you," said Mr. Morrow, "that these advocates of stabilizing the production of coal, of regularizing the industry, who seem to think that all they need to do is to order the operator to run his mine regularly, have another guess coming. The operator would be glad if somebody would arrange it for his mine to operate regularly, but the consumer is the man who determines when a coal mine is going to operate; and if the government is going to see to it that the mines in those seasonal Western districts operate regularly throughout the year, some government authority must say to the householder: 'Today is the day for you to take your bituminous coal, whether you want it and are ready for it or not.'"

Production is increasing, Mr. Morrow said, and there is no reason at all to believe that it will not continue to increase and increase materially as the demand for the coal makes it possible for a number of mines to operate that have not been operating simply and solely because of lack of orders, not that they were shut down on account of a strike. They weren't able to find a demand for the coal.

"Now it is proposed that the government intervene in this strike," continued Mr. Morrow. "I suppose there are at least a thousand earnest, sincere theorists of some kind who know some definite, sure way of preventing this strike and preventing all strikes in the future. They can't all be right, because they don't all have the same idea. Right at the beginning then we can just set it down that a few of them are wrong.

"I want to add just one other suggestion to it: We had a pretty good object lesson in what the government could do and couldn't do in the regulation of business during the war. Suppose the government today owned all the coal mines, that they were nationalized, as Mr. Lewis, the president of the miners, demands, what would the government do about it? As a practical proposition what could it do?

"Gentlemen, it couldn't do a single thing that the operators themselves are not doing, except one. The one thing it could do is to tell you how much coal to take in and when and from what mines you are going to get it. That is all; not another single, practical thing could it do that would force these mines to operate more regularly, that would give these men steadier work, that the operators can't do. The operators wouldn't shed any tears at all if the government operated the mines. That is your problem. When John Lewis begins to talk about nationalizing the coal mines you want to understand he is talking about nationalizing your chief source of raw material.

What would happen to the cost of production under those conditions? Now, a railroad is all out on the top of the ground; you can see it; you can observe the condition of the track and the motive equipment; you can tell whether the agents of the road and the employees of the road are efficient, courteous, or not. A coal mine is all underground, subject to falls of the roof and to fires, and a thousand and one misfortunes can befall the investment. It takes the constant, careful scrutiny of the men whose money is invested in the property to safeguard the investment.

"What do you suppose would happen if the government clerks were taking charge of that? I suspect if it was in the hands of the government somebody would be sent to go down into the mines. You know what the result would be. There isn't anybody alive that could estimate how much would be added to the cost of coal in the United States if the government had the job of running the mines and supplying you with this coal.

"In conclusion, let me say this is one of the elemental struggles in American industry; it is a part of the after-the-war readjustment. The only reason the United Mine Workers today doesn't have this country and its industry at its throat is that there are four million tons of coal coming out of the ground every week from mines that are not subject to the unions and if the United Mine Workers can dictate the ways of operation, the wage scale in these union mines, you will pay more than you are now paying, or else you will see the gradual extension of these non-union mines because you will buy more and more coal from them. It is absolutely hopless to expect that these two sections of the bituminous coal industry, two-thirds of it unionized, the other third non-union, will run along in competition with each other on the basis of a difference of a dollar or so in their production costs. You will have to answer that proposition. The coal operators understand perfectly well how you will answer it.

"As I said a moment ago, you are as directly interested in this coal strike as the men in it themselves are interested; it is as much your struggle as it is theirs. You want it settled on the basis of sound, economic principles, otherwise the base under your business is not steady and sound and stable. Therefore these coal men need your intelligent sympathy and your support, and I sincerely hope that they will have it."

Ashmead Broadcasts Lecture on Coal

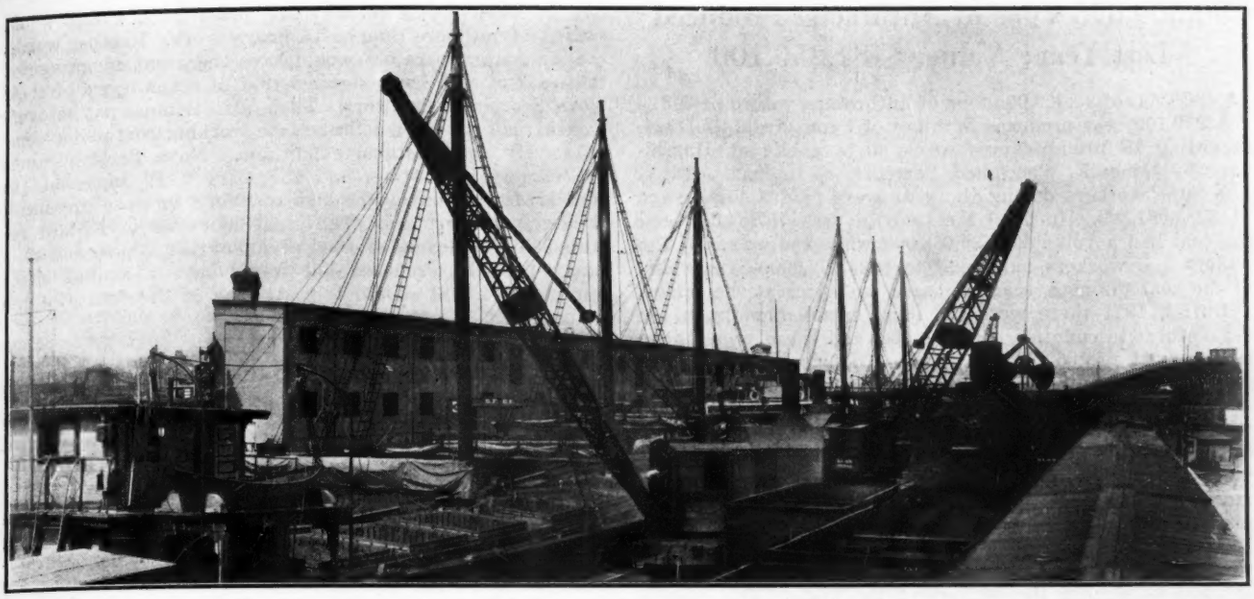
ON SUNDAY, May. 14, Dever C. Ashmead, of Kingston, Pa., anthracite editor of *Coal Age*, delivered, by radio, a lecture on the mining and preparation of anthracite from the Newark station of the Westinghouse Electric & Manufacturing Co.

Owing to the large number of small radio sets with a limited radius, this lecture was also broadcasted from the East Pittsburgh station on May 18 and also from the Springfield, Mass., station of the Westinghouse company on May 15. It is estimated that about 500,000 persons were able to listen in.

THE PRINCIPAL SPEAKERS at the annual meeting of the National Coal Association will be the chairmen of the association's committees. The chairmen will tell the gathering of the work of their particular committees during the year and outline the things it is necessary for them to do during the coming twelve months. Each chairman's talk will be followed by interrogations and discussion from any member of the association.

J. G. Puterbaugh and A. J. Malone also will give talks on coal salesmanship. The meeting will be held at the Congress Hotel, Chicago, Wednesday and Thursday, May 24 and 25.

AFTER JULY 1 a separate coal commodity division will be set up by the Department of Commerce. F. R. Wadleigh will be its chief. At present the fuel division, of which H. C. Morris is chief, handles both coal and petroleum. With the beginning of the new fiscal year, however, petroleum as well as coal will be given the increased attention made possible by a separate division. Mr. Morris will continue with the petroleum work. Under this arrangement each commodity will receive the additional attention which the increased allotment of funds will make possible.



LACKAWANNA RAILROAD UNLOADING SMOKELESS COAL FROM BARGES INTO RAILROAD FUEL CARS, HOBOKEN, N. J.

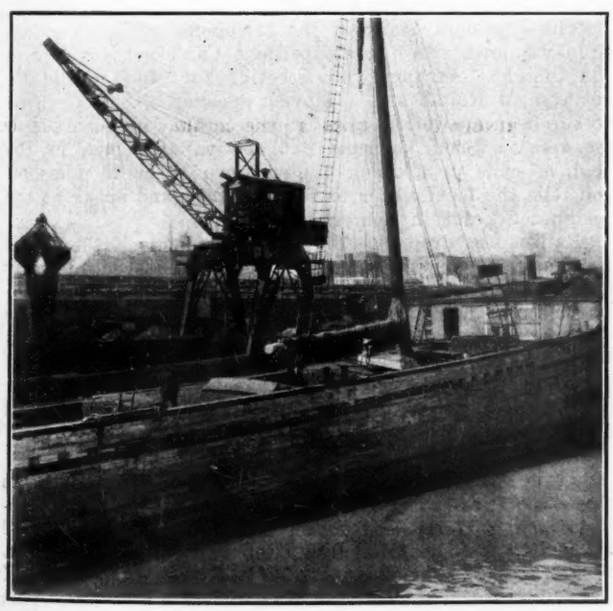
Reversing the Normal Coal Movement

PRESENT conditions in the coal industry have resulted in a practical reversal of some of the normal currents in the flow of fuel. Thus under ordinary circumstances coal moves from the interior to the sea coast. This is particularly true of such ports as New York, the soft coal reaching this harbor coming almost exclusively by rail. At this port coal arriving on cars may be transferred to barges or lighters for delivery at points possessing water connections but being more or less remote from the place of transfer.

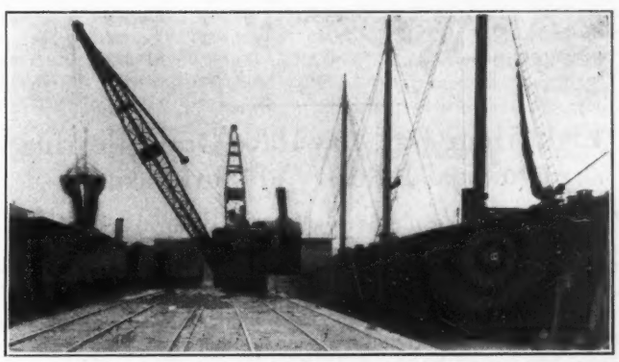
This normal movement is today so far reversed that coastal barges are now being loaded at Hampton Roads with coal from the non-union fields of West Virginia and Virginia and thence brought to New York, where their cargoes are transferred to railroad cars for shipment inland. The accompanying illustrations show such barges being unloaded at the docks of the Delaware, Lackawanna & Western R.R. at Hoboken, N. J. These photos also well illustrate the flexibility and general utility of the locomotive crane.

In size the barges used range from about 2,000 to 3,500 tons burden. They are usually made up in tows of two or three, the total weight of cargoes being from about 7,000 to 8,000 tons. Such a tow in charge of a tug can make the trip from, say, Lamberts Point in from 48 to 50 hours if the weather is fair.

Southern coal has been moving into New York Harbor in considerable volume since the strike began, but it is only in the last week that there has been serious effort made to reload this coal into open-top cars for inland delivery. The facilities in New York Harbor for handling coal are designed to unload the coal from cars into barges or scows, and it is generally recognized that facilities for picking the coal out of boats are entirely inadequate to take care of any large movement in the direction which is the reverse of normal. It is estimated that the locomotive cranes which are pictured in these illustrations will each load a railroad car in one hour.



LACKAWANNA RAILROAD TAKING FUEL COAL FROM BARGE "BALTIMORE"



LOCOMOTIVE CRANE TAKING COAL FROM BARGE "WELLESLEY" AT PIER 8, HOBOKEN

GASES AND COAL DUST fired by an electric arc caused the recent Sopris No. 2 mine explosion near Trinidad, Col., in which seventeen workmen lost their lives, according to a report just made public by State Coal Mine Inspector James Dalrymple. No specific blame was laid to any of the coal-mine officials. The explosive gases were accumulated through an open door in the underground workings.

FEDERAL INVESTIGATION of the eviction of miners from their homes in the Kentucky-Tennessee district has begun with the arrival in Knoxville, Tenn., of Dr. F. G. Davis, commissioner of conciliation of the Department of Labor, sent to that district at the request of District President S. A. Keller, of the United Mine Workers of America, that Washington authorities take some action in the matter.

90,509,075 Tons of Anthracite Produced Last Year; Value, $481,250,100

A TOTAL of 90,509,075 tons of anthracite, valued at $481,250,100, was produced in mines of Pennsylvania in 1921, according to preliminary figures made public at Harrisburg by James F. Woodward, Secretary of Internal Affairs. The mine workers during the year were paid a total wage of $283,961,300. In 1920 the tonnage was 79,364,600 and the coal had a value of $436,488,000 while the wages of the miners and workers amounted to $237,302,900. The value of the coal for both years is based on prices at the mines.

During 1921 there were 193 mine establishments in the ten anthracite counties of the state, and these mines gave employment to 166,820 employees. Of this number, all of whom were males, 77,571 were Americans, white; 172 were Americans, colored, and 89,077 were foreigners. There were only 25 boys under the age of sixteen years engaged in the operations. In 1920 there were 187 coal-mining plants in the anthracite counties and 144,551 employees were engaged. There were 67,299 Americans, white; 333 colored, and 76,919 foreigners engaged in the mines in that year.

Of the total anthracite mined in 1921 in Pennsylvania, the great bulk, as represented by valuation figures, was shipped outside of the borders of the state. The records show that while all of the anthracite mined in the state had a value of $481,250,100, the coal shipped out of Pennsylvania had a value of $390,829,000.

The number of employees engaged in anthracite mining last year, the amount of wages paid, the tonnage produced and the value of the production were as follows:

Counties	Average No. Employees	Total Wages	Tonnage Produced	Value of Output
Carbon	5,365	$8,824,300	2,720,017	$13,825,200
Columbia	1,350	2,251,000	909,715	4,348,500
Dauphin	1,786	3,036,200	818,723	4,177,400
Lackawanna	34,291	57,913,300	16,669,170	94,462,600
Luzerne	70,913	120,989,200	41,256,822	223,401,900
Northumberland	13,577	23,155,500	6,690,301	34,290,100
Schuylkill	36,877	63,540,400	20,013,357	99,602,800
Sullivan	765	909,800	350,838	1,748,500
Susquehanna	1,064	1,722,800	493,682	2,595,700
Wayne	832	1,618,800	586,450	2,797,400

Eight-Hour Day May Have Grave Bearing On Coal Industry of Nova Scotia

THE eight-hour day is now in effect in British Columbia, and is under discussion for the coal mines of Nova Scotia. The Canadian Institute of Mining and Metallurgy (May, 1922) thus summarizes the arguments:

"The question of an eight-hour bank-to-bank bill, as far as Nova Scotia is concerned, must be looked upon largely from the economic situation of coal mining in the province. The present eight-hour working arrangement with the mine workers is elastic, and means generally that the men underground work approximately eight hours. The surface men as a rule work eight hours and, occasionally, possibly eight and a half hours, so that the coal of the contract miners be taken out or away. The enforcement of a rigid eight-hour bank-to-bank day would mean, in many of the mines, that the miners would not be at work at the face for more than six and a half hours. A reduced output would be the certain outcome. Such reduction would mean that the cost of production would be increased or that the miners must be content with a correspondingly lessened wage.

Suppose the miners will not submit to any wage reduction; the increased price of coal to the public is worthy of most serious consideration. Further, it will so seriously affect the industry that efforts after competitive markets will be futile. The coal produced for sale in the province is comparatively small. The bulk of the output must be exported to points where it meets active American competition. Were this bill to become law, provincial would enter into competition with American coal, which to a large extent is produced under a nine-hour day. An eight-hour day in Nova Scotia means that, practically, a day would consist of not more than seven hours' work. In other words, the American operators would have the great advantage of the work of nine hours against that of seven hours of their Nova Scotian competitors. Then, also, it must not be overlooked that the United States are working coal under comparatively easy natural conditions. Nova Scotian mines are largely submarine, and therefore it is impossible to sink shafts to convey the men to points in close proximity to the working faces. The eight-hour law in Britain resulted in the closing of several submarine mines, and it is likely that the proposed bill would have a similar effect here; and if that should follow, what of the future of the industry?"

Organizing George Baer's Old District

UNDER the caption "Liberty and Union in the Coal Fields," in *The Nation* of May 17, 1922, Heber Blankenhorn says, in part:

"Somerset produced George F. Baer, president of the Reading Railroad, who in the great strike of 1902 assured the country that 'the rights and interests of the laboring man will be protected and cared for, not by labor agitators but by the Christian men to whom God has given the control of the property interests of the country.' His honored photograph adorns the walls of lawyers' offices near Somerset Court House. His gospel is the creed of Somerset coal operators today.

"Somerset County, bounded on the north by the non-union section of Cambria County and on the south by the Maryland border, buttressed on the west by the non-union Connellsville and Westmorland fields, has been kept non-union for years, excepting a half dozen half-submerged locals in the Meyersdale region. Now, twenty-seven mining towns are strike-bound and locals are organizing in every camp. Ten thousand men in Somerset, eight thousand in Cambrai, Indiana, and northeastern Westmorland counties, with the 43,000 of District No. 2 of the United Mine Workers, make a total of 60,000 on strike in central Pennsylvania, according to their leader, President Brophy. A big mine in Johnstown, a small one in Bell, mines in Vintondale and Colver and Charles M. Schwab's at Heilwood—these were about all that were left working on May 3. The operators call it a plot; it looks like a landslip. . . .

"Field headquarters of the union is at Cresson, on the edge of District No. 2. A room jammed with three desks, a table, two typwriters, two telephones. At the other end of the building, one of District 2's 28 co-operative stores. It is Saturday evening, April 22.

"Vice-President Mark at the telephone. 'No, President Brophy's down there at a meeting. Can't get anybody to you tonight. Arrange your meeting for Monday and I'll get you an Italian and a Slavish speaker.' All afternoon he has been answering calls from recently formed locals in Somerset. When he runs out of available men in the field, he calls up a union mining town 10 or 20 miles off and tells the local officer to take a jitney and speak at the designated point in Somerset.

"Railroaders drop in. They want to know if they can't distribute the union's papers on their run. Truck delivery men make the same offer. Organizer Donaldson, a youngster, reports how the meeting went at Cambria City. He had gone alone. 'The boys had a hall all right. I found the road in front of it blocked solid with the supers' and bosses' cars. There were just little passages left at each end of the autos for the miners to squeeze by, and about 40 thugs made a gauntlet there.'"

JAMES DALRYMPLE, STATE COAL-MINE INSPECTOR, reports that 12,909 men were employed in the coal mines in Colorado during March and that there was a total output of 982,868 tons. The total production in Colorado from Jan. 1 to March 31 amounted to 2,577,084 tons, an increase of 148,610 tons over the corresponding period a year ago. This is more encouraging than forecasters figured on when they made estimates a month ago.

Sixth Week of the Coal Strike

EDITORIAL REVIEW

FEDERAL intervention in the strike seems further away than it did a week ago. For a time stocks were being consumed so rapidly that it seemed inevitable that public inconvenience was about to result, with the necessary consequence of pressure for government intervention. The demand for coal, however, has increased to the point where it is evident that most requirements are being met by current deliveries.

Washington is watching developments in southeastern Kentucky with much interest. This first defection from the union is thought by some to be the beginning of disintegration which may spread to other fields where the union is not impregnably established. In this connection, however, it is pointed out that the union well can afford to lose some strength in borderland territory if it can bring permanently into its ranks the non-union men who have gone out in central Pennsylvania. Washington has not yet recovered from its surprise at the union's success in pulling out these men.

It has become increasingly clear that non-union operators have not profited by the lesson of overdevelopment in other fields. They have felt little of the financial loss which has visited other operators during the last eighteen months. The more favorably situated mines have enjoyed no small degree of prosperity. As a result a large number of new mines are being opened in non-union territory. Since overdevelopment in the non-union field is much more serious than in a union field, this tendency is being regarded with some apprehension.

When the freight-rate decision is put into effect it will be much easier to figure on wage rates. Thus far in the strike this factor alone has made for many uncertainties. With rates at the existing level, Illinois enjoys no small amount of tariff protection as against the East.

At the end of the sixth week the strike has practically faded out in so far as public interest is concerned.

New Bill Proposes Investigation Body of Three to Supply Data for Coal Legislation

A BILL creating a coal investigation agency of three members to "inquire into cost conditions in the coal industry" has been introduced in the House by Representative Petersen, of Brooklyn, N. Y., and referred to the House Committee on Mines and Mining. Unlike the Bland bill, which proposes a similar commission, the Petersen bill confines the work of the proposed commission to "providing information for Congress as a basis for legislation" and specifically to "determine what items make up the difference between the cost of coal at the mines and the cost of coal to the consumer." The proposed commission is to continue for one year. The usual inquisitorial powers proposed in similar bills for such an agency is provided in the Petersen bill.

Illinois Just Waits and Waits; That's All

NOTHING occurred in Illinois or adjoining states during the past week that gave evidence of bringing the end of the strike any nearer. Reports from almost every mining field told of peace and tranquillity reigning there, of married men living on their savings and the income of odd jobs, and of many unattached men drifting off to destinations unknown. The miners show few signs of suffering.

Operators, seeing little general demand for coal, are not fretting about non-operation. They fret more about the rumors now going around the country that they have made some sort of a secret deal with Frank Farrington, state mine leader, for the adjustment of the labor question at such time in the future as Farrington feels that his men are keen to go back to work. Some of the men would like well enough to get to work, according to stories brought in from the fields, but there is nothing but positive and indignant denial of the "secret deal" rumor.

Of greater concern to the substantial part of the coal trade in the Midwest region is the trend of affairs in Kentucky. There the swift ascent of prices and the many reports of broken contracts and questionable tactics on the part of some western Kentucky operators cause some apprehension lest bad business conduct draw down upon the whole coal industry the ire of a powerful government.

Anthracite Miners Object to Four-Year Agreement, with Annual Wage Adjustment

THE joint sub-committee of anthracite mine workers and operators negotiating a wage agreement held three sessions in New York City last week, an adjournment being taken on Wednesday, May 10, until May 16 to enable the miners to attend the 21st annual convention of the Pennsylvania Federation of Labor, which was held in Scranton.

At the session held on May 9 the operators submitted a proposal that an agreement be drawn for four years instead of two, as asked by the mine workers, and that the wage issue be adjusted each year. This met with opposition from the miners. A short session was held on May 10.

No intimation has yet been given by the operators as to what their wage demands will be.

West Virginia Coal Production Increasing Steadily Since Strike Began

COAL mining in West Virginia has shown an increase since the nationwide strike began, compared with the average monthly production for the preceding 10 months. Loadings in Logan, Williamson, Winding Gulf, Pocahontas and the Tug River districts have shown steady increases in the reports forwarded to the West Virginia Coal Association.

"Had the demand for coal been anything like some people expected at the time the United Mine Workers were planning to create a coal famine to win the strike, the nation would have found that West Virginia could have turned out much more coal than was produced in April," said Walter H. Cunningham, secretary of the West Virginia Coal Association. "The market is all that held us back. We have about 900 unconsigned cars of coal on railroad sidetracks, showing that we produced more than we could sell."

The production in the former union fields also has shown a continued increase and more operations are being reopened daily. In the New River district the petitions of miners for work at the November, 1917, scale, are being considered as fast as arrangements can be made to give them work, according to T. L. Lewis, secretary of the New River Coal Operators' Association.

In the northern part of the state many more mines were reopened in hitherto union districts during the last two weeks in April; the only difficulty the operators say they met was inability to take back all their employees.

The Logan field has broken all production records since the strike, having loaded as high as 1,200 cars daily, the average being about 1,100 cars. Total production for the month was 1,380,000 tons. Although there were only 25 working days in April, compared with 27 in March, last month's output exceeded that of March by 30,000 tons. Previous to the strike the average was about 1,000 cars a day. Before the strike, however, with the demand below normal, many days were lost and production was much below the average.

In the Williamson district the daily average production in April was around 24,000 tons, with an increase noted

each week. Beginning with the week ended April 1, when 112,000 tons were loaded, the other loadings were:

Week ended April 8, 117,000 tons
Week ended April 15, 121,000 tons
Week ended April 22, 134,000 tons
Week ended April 29, 145,000 tons

"There are 35 mines now working in the Kanawha field, with a number ready to reopen," said Duncan C. Kennedy, secretary of the Kanawha Coal Operators' Association. "We are mining right up to the maximum of the demand and we can mine more if there is a larger market."

Union Losing Ground in West Virginia; Reverses Most Severe in District 29

SIX weeks of the strike in West Virginia has greatly weakened the United Mine Workers' organization and the longer the strike lasts the more certain it is that only a remnant of the union's former strength will be left. Not only has the union failed to gain ground in West Virginia but, it is reported, it has been unable to hold its own membership intact and union miners themselves are helping to break the strike either by going to work in non-union fields or by working in non-union mines in union territory, where they are not known.

The union is sustaining its most severe reverses in District 29, which covers the New River field and a small part of the Winding Gulf region. The union has made no progress in the Winding Gulf district and the effort to bring that region into the union fold has been given up, it is reported. Within the last few days it is said the Kaymoor, Elverton, South Caperton, Thayer and the Long Branch mines have all resumed operations. New River miners are now seeking employment in the non-union Winding Gulf region, where most of the men who struck on April 1 have returned to work. It is only a question of a few weeks, in the opinion of operators, before virtually all of the New River plants will be in operation, under an improvement in market conditions and through defections in the ranks of the strikers, and when New River miners are all back at work, it will mean that the Kanawha field alone will remain to the union, and even here the mines are gradually resuming work.

More than half of the 1,421 mines in the state are now on a non-union basis and the union can claim only between 500 and 600 mines as being under its control in so far as operation is concerned. Of the 550 mines in northern West Virginia, for instance, there are now 123 in operation, or twice as many as was the case at the inception of the strike, with the number being increased from week to week, as miners realize that they cannot depend on the union for any financial aid during a period of idleness.

Union Unable to Continue Rations, New River Strikers Would Return to Mines

THERE were breaks in the ranks of the strikers in the New River district of West Virginia before the middle of May, according to reports from this district. This is attributed by operators to the impression now prevailing that the United Mine Workers organization is not in a position to continue the issuance of rations to striking miners in the New River field. First reports of a general change in the situation were from Thurmond, where it was understood that miners heretofore on strike were seeking reinstatement at the various mines in the district. Not only were there reports of reinstatement but in many instances the men have already returned to work, as for instance at the mines of the Table Ridge Coal Co., the Rock Lick Coal Co., the Wee Win Coal Co., the Meadow Fork Coal Co., the Stover Coal Co., and the Elverson Coal & Coke Co.

Developments in the New River district, which has been affected more than any other smokeless field by the strike, lead operators to believe that within a short time virtually all the mines in this territory will be in operation again.

Deadlock in British Columbia; Operators Insist That Reduction Date from April 1

COAL mines of the Crowsnest Pass district and other parts of eastern British Columbia closed down on April 1. The situation is at a deadlock according to the Canadian Institute of Mining and Metallurgy (May, 1922). The operators are willing to have differences go before a board of conciliation, as provided by the Industrial Disputes Act, on condition that the reduced wage scale has effect as from April 1. The men want the present scale to continue while the board is in session. The operators are firm for their point and pending its acceptance have not named their representative to the board.

All union mines comprising District 18, Alberta, are closed, and efforts have been made to induce the men working in the unorganized mines in the province to join the strike. Considerable attention has been paid by the executive of the U. M. W. to the Brule mines, but the latest reports indicate that the men are well satisfied with things as they stand at Brule, and the mines there are working on full time. Attempts also are being made to bring out the miners in the Coal Branch, but it is unlikely that they will meet with success. The Evansburg district, following a reduction in wages, attempted to organize under the United Mine Works, but this proposal appears to have met with little support. Pembina Collieries, at Evansburg, however, closed on April 1 for an indefinite, period, owing to lack of orders.

Mines in the Edmonton district are still working, though not full time. This district is not organized under the U. M. W. A. and therefore has not been affected by the strike. The price of coal in Edmonton has fallen, and satisfactory settlements with regard to reductions in wages are being made with the miners.

Scott Conciliation Board Holds Session; Nova Scotia Dispute Still Unsettled

THE Scott Board of Conciliation appointed to investigate the wage dispute between the British Empire Steel Corporation and the Nova Scotia coal miners held a session at Sydney, N. S., on May 6. D. H. McDougall, vice-president of the corporation, presented the company's side of the case, contending that competition from American and English coal mines had been so keen that operators were compelled either to lower wages or stop mining coal. By trying to force a higher rate of wages the miners were seeking to destroy the livelihood of both employers and employees. West Virginia coal was underselling the output of the Cape Breton mines in Montreal and the company's hopes for a good season in that market had met with disappointed.

J. B. McLachlan, district secretary-treasurer of the United Mine Workers, on behalf of the miners presented statistics to show that wages had not increased in proportion to the rise in cost of living. Robert Baxter, district president of the union, demanded the production of the company's cost sheets covering a period of several years and was supported by Isaac McDougall, the miners' representative on the board. Vice-President McDougall said that while the company had no objection to producing these cost sheets for the confidential information of the board it was unfair to ask them to be given to the public. The matter was left over for further consideration.

All Quiet Again in Utah Coal Camps

COAL camps in Utah are extremely quiet following the declaration by state authorities that they were going to maintain order at any cost. It is difficult to say whether this is the quiet that precedes a storm or is evidence that the strike is collapsing. Many coal men take the latter view. State Industrial Commissioners Knerr and McShane are still at the scenes of recent trouble conferring with workmen and union leaders.

THE HIGHEST EXPLOSIVE KNOWN to science is made by combining idle hands and addled minds.—*Fremont Tribune.*

Colorado Operators Not Greatly Worried

OPERATORS in the Colorado fields show little or no concern over the strike situation. Since the declaration of the Victor American Fuel Co. for the open shop, practically all big operators are ignoring union organizations. All of the large operators in the state are mining more coal than they can sell in the present state of demand.

The Colorado Fuel & Iron Co. now has eighteen mines in the Walsenburg, Trinidad and Crested Butte districts in operation at a capacity more than sufficient to meet the demand of its customers. This company has the only large mine—the Fremont—in operation in the Canon City district. Two or three other mines in that district now working are wagon mines many miles from the railroads.

Other large operators in the Canon City district are not attempting to open the mines, mainly on account of the lack of demand. The Colorado Fuel & Iron Co. alone has at its loading points 400 cars of unbilled coal. This is true of all Colorado companies.

Practically the same situation exists in the northern field, where more coal has already been mined than can be disposed of. The Rocky Mountain Fuel Co., the National Fuel Co. and the William Russell Coal Co. are all operating mines in this district now.

State to Call Logan County Defenders In Blizzard Treason Trial

BEGINNING what it is believed will be the last week of the trial in Circuit Court at Charles Town, W. Va., of William Blizzard, president of subdistrict 2, United Mine Workers of America, charged with treason in entering into a conspiracy to levy war against the State of West Virginia, the prosecution was prepared to embark on a new line of evidence when court reconvened Monday, May 15. For more than two weeks the testimony concerned mainly the preparations for the armed march, raising of money, speeches at union meetings, the march, and incidents of the fighting itself. Just before adjournment Saturday the state began to present the other side of the picture, that of the Logan County defenders. The testimony of many of the men from all parts of the state who held the lines of defense against attack until federal troops arrived to restore order is expected this week.

Captain John J. Wilson, commander of the first troops to enter the troubled area, testifying May 8, said he made it his duty to learn what was in the minds of the miners, who, he declared, did not really know what they were fighting for. From the point of view of the regular army officer, he described the fighting as a "comic opera war," but in relating the activities of the company he commanded, he said he found Blizzard highest in authority of the men he met among the miners.

Other witnesses were Adjutant General Charnock of West Virginia and residents of towns close behind the irregular fifteen-mile line along which the forces met.

Under cross-examination the Captain said Blizzard showed no antagonism toward the federal troops, and that "without him it would have been a ticklish job" to disarm the marching miners. It was the general impression they were "glad the game was up and that the federal troops were coming in."

"They were obsessed," said the witness, "with the thought that the thugs from Logan were bent on destroying their homes and killing their women and children." When state's attorneys asked who spread this "propaganda" among the men, Captain Wilson said they got it "from their unions."

Testimony of ten other witnesses heard on May 8 was mainly in corroboration of details of the march and fighting formerly told.

The lives of Logan County defenders who were captured were in such danger that leaders of the attacking forces hid the prisoners in the mountains for safety, according to the testimony May 9 by Sam Hulme, one of the prisoners. Other witnesses told of the seizure of supplies and money and conscription of men by the marchers. The prosecution placed three army rifles in evidence. As a counter-exhibit the defense presented the casing of a bomb alleged to have been dropped by an airplane.

Testifying May 10, Edgar Combs said the column with which he was going into the hills met three men in a hollow, Combs and Rev. J. E. Wilburn, of Jeffrey, marching at the head as leaders, he said. The columns halted in such a way that he could not see, the witness testified, but he heard both sides ask for the password. Somebody said, "Amen," understood to have been the Logan password, and immediately about thirty-five shots were fired. Afterward, he said, he saw three bodies.

Trade Commission Files 169-Page Brief in Support of Right to Exact Cost Data

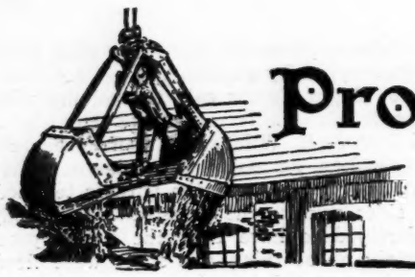
IN SUPPORT of its contention in its case against the Claire Furnace Co. and other iron and steel interests, that it has a right to require cost data from basic industries, the Federal Trade Commission has filed a brief and argument of 169 pages in the District of Columbia Court of Appeals. The brief was filed preliminary to argument before this court on the commission's appeal from the Supreme Court of the District of Columbia, which sustained the contention of the steel interests that the commission was without authority to require this information. Determination of the suit is of interest to the coal trade as the commission's right to gather statistics as to cost of production in the steel, coal and other basic industries is involved.

In its brief the commission contends that Congress has power to require cost data through one of its created agencies, that this power includes the right to require intrastate information, that the constitutional power does not rest alone on the interstate commerce clause and that the power is supported by long exercise and recognition. It also contends that the Federal Trade act lawfully grants the power exercised, and that no rights of the companies were invaded by seeking this cost data. The commission also refers to the taxing power, the census power, the war power, and the inherent powers of the government to obtain this information, refers to similar governmental activities, and the recognition of the value of the information sought and of regulation by publicity. A long list of court cases is cited by the commission to support its contention, as also a list of laws, including the Bureau of Corporations Act, the Federal Trade act, appropriations acts, Tariff Commission act, census law, National Defense act and the Interstate Commerce act.

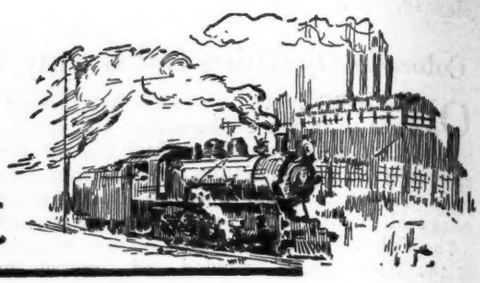
U. S. Supreme Court to Review Bankruptcy Ruling Against Tidewater Coal Exchange

THE U. S. Supreme Court has been requested to review the decision of the Circuit Court of Appeals, Second Circuit, in a case involving credits and debits of the Tidewater Coal Exchange, which operated a coal pool at New York during the war. The case comes on appeal by the Delaware Steamship & Commerce Corporation vs. the New England Coal & Coke Co., the Seaboard By-Products Coke Co., Dexter & Carpenter, Tidewater Coal Exchange, Archibald McNeil & Sons Co. and the protective committee of shippers of the Tidewater Coal Exchange.

The New England Coal & Coke Co., the Seaboard By-Products Coke Co. and Dexter & Carpenter Co. filed in the Southern District of New York Court a petition in bankruptcy against the Tidewater Coal Exchange, setting forth that they were creditors of the exchange by reason of establishment by the exchange of credits for coal delivered to the exchange on their account. Due to withdrawal of excessive amounts of coal from the pool established by the exchange, it developed that some members of the exchange had paid $403,269 for coal drawn in excess of allotments while $1,182,034 was due from those who had not paid for excessive withdrawals. When the exchange ceased business in 1921 it notified the court that it was not certain whether it was subject to the bankruptcy act. The District Court decided that the exchange was bankrupt, which was affirmed by the Circuit Court.



Production and the Market



Weekly Review

WITH the Lackawanna Railroad taking smokeless coal from southern West Virginia by barge from Hampton Roads, unloading the barges in New York Harbor into open-top cars for railroad fuel west to Buffalo, and with the reverse of this, the Pennsylvania Railroad taking smokeless coal off the Norfolk & Western west and north to Columbus and then east to Manhattan Transfer, one has a picture of the topsy-turvy condition of the market in the East. The liveliest market this week centers in New York City and extends south to Baltimore. Except for water-borne coal from Hampton Roads there is little tonnage available in these markets, and the Inland buyer, who is not readily served by Tidewater delivery, is becoming panicky. There are not many coal consumers in the market in this area, but the price they have to pay for coal is increasing every day.

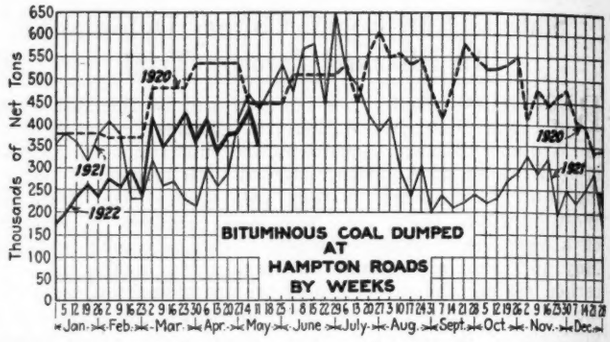
Lively Bidding for Available Coal

For the coal from the one real source of supply, southern West Virginia, West Virginia and eastern Kentucky, the Atlantic seaboard is bidding against the steel industry and the West. Spread over the whole market is the beginning of heavy buying by the railroads. Chicago is leaning heavily on western Kentucky, a union field operating under a contract that runs throughout this year. As an indication of what some buyers are willing to pay it is interesting to note that emergency freight rates established since the strike began, from N. & W. and C. & O. fields to Pennsylvania points range $3.38@$5.55 per gross ton, to which must be added, of course, the mine price of coal, which is now above $3.

Both the New England and Northwestern markets are quiet, and the market in the Far West is without feature. Demand for fuel for some steel plants on Lake Erie is moving coal in such volume from Toledo to Buffalo that boat rates have been marked up. It is reported that steel manufacturers at Sandusky have bought coal at Duluth and will ship it down. Canadian railroads are buying coal off the Duluth docks to be delivered by boat.

Coal Age Index of spot prices of bituminous coal increased 31 points to 261 on May 15. The number of coals that are available is steadily growing less as the supply of no-bills diminishes.

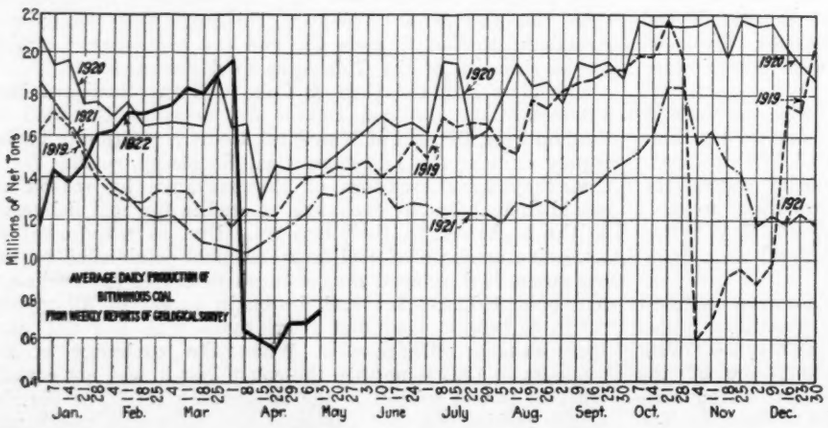
Production continues gradually to increase as the price goes up. There are many small mines, particularly of the wagon variety, that are reported to be ready to begin production of a few cars a week each of what will pass for coal when the price gets above $4.



BITUMINOUS

"Production of soft coal increased at the beginning of the sixth week of the strike," says the Geological Survey. "The early returns indicate an output of close to four and a half million tons. Production of anthracite, however, remains practically zero.

"The revised figures for the fifth week (May 1-6) show 4,161,000 tons of bituminous coal, and 6,000 tons of anthracite, a combined output of 4,167,000 tons. In the corresponding week of the 1919 strike 5,245,000 tons of soft coal and 2,014,000 tons of anthracite were produced, a total of 7,259,000 tons. The current output of all coal,



Estimates of Production
(Net Tons)

	1922	1921
BITUMINOUS		
Apr. 22 (*b*)	3,575,000	6,815,000
Apr. 29 (*b*)	4,175,000	6,984,000
May 6 (*a*)	4,161,000	7,391,000
Daily average	694,000	1,232,000
Calendar year	148,691,000	134,542,000
Daily av. calendar yr.	1,396,000	1,264,000
ANTHRACITE		
Apr. 22	6,000	1,903,000
Apr. 29 (*b*)	5,000	1,945,000
May 6 (*a*)	6,000	1,633,000
COKE		
Apr. 29 (*b*)	89,000	76,000
May 6 (*a*)	90,000	70,000
Calendar year	2,395,000	2,920,000

(*a*) Subject to revision. (*b*) Revised from last report.

therefore, is some 3,000,000 tons a week short of the 1919 experience.

"For the first time since the strike began loadings passed the 13,000-car mark on Monday of last week (May 8-13). Yet the record of Monday was exceeded on each of the days following, and the returns so far received for Friday forecast a production of from 4,400,000 to 4,500,000 tons for the week. In comparison with the week preceding this is an increase of 9 per cent. The following table of cars loaded daily shows the trend of production:

	1st Week	2nd Week	3rd Week	4th Week	5th Week	6th Week
Monday	11,445	10,772	7,898	12,131	11,598	13,045
Tuesday	11,019	10,658	10,041	12,377	12,160	13,260
Wednesday	11,437	10,961	11,088	12,622	12,861	13,384
Thursday	11,090	11,482	11,193	12,981	12,487	13,234
Friday	11,296	10,714	11,596	12,362	12,778	.....
Saturday	8,888	8,501	10,194	11,295	11,265	.....

"At the end of the fifth week of the strike the accumulation of unbilled loads had been reduced to the level of March 4, two months before. The average number of coal loads unconsigned daily during the week ended May 6 was 13,959 cars of bituminous and 779 cars of anthracite. Compared with the week preceding, this was a decrease of 21 per cent for bituminous and 25 per cent for anthracite."

All-rail movement to New England declined during the week ended May 6, when 703 cars of bituminous coal were forwarded. Pennsylvania grades are now priced so high that this rail movement is mainly confined to contract shipments as New England is not yet in such need of coal that it will pay the going price for central Pennsylvania coals.

Dumpings at Hampton Roads declined to 344,432 net tons during the week ended May 11, as compared with 433,960 tons in the preceding week. The flow of coal to the piers has decreased because of the heavy demands from other sections made on the mining fields. The market stiffened a full dollar during the week.

TIDEWATER BITUMINOUS COAL SHIPMENTS FOR APRIL, 1922
(In Net Tons)

Destination	New York	Philadelphia	Baltimore	Hampton Roads	Charleston	Total
Coastwise to New England	742,000	7,000	16,000	807,000	.....	873,000
Exports	.....	13,000	16,000	246,000	27,000	302,000
Bunker	195,000	28,000	22,000	203,000	5,000	453,000
Inside capes	.....	127,000	46,000	68,000	.....	240,000
Other tonnage	406,000	1,000	2,000	266,000	.....	675,000
Total	643,000	176,000	102,000	1,590,000	32,000	2,543,000

Lake dumpings for the season to May 1 were 834,533 net tons, compared with 1,289,160 tons in 1921 and 329,202 tons in 1920. April dumpings were 621,236 tons, compared with 204,040 tons in March. Recent dumpings are being shipped to Buffalo and other lower ports where there is an active demand for fuel, and the Head-of-the-Lakes docks, instead of getting additional cargoes, are reported to be receiving inquiries for shipment down the Lakes. During April upbound "Soo" passages were 109,000 net tons of soft coal and 5,000 tons of anthracite.

How the Coal Fields Are Working

Percentage of full-time operation of bituminous coal mines, by fields, as reported by the U. S. Geological Survey in Table V of the Weekly Report.

	Six Months July to Dec. 1921	Jan. 1 to Apr. 1, 1922 Inclusive	Apr. 3 to Apr. 29, 1922 Inclusive	Week Ended Apr. 29
U. S. total	45.6	55.7	....	....
Non-Union				
Alabama	63.5	64.6	70.8	69.0
Somerset County	55.5	74.9	73.5	64.0
Panhandle, W. Va.	55.3	51.3	33.8	40.8
Westmoreland	54.9	58.8	68.6	53.1
Virginia	54.8	59.9	69.0	83.2
Harlan	53.3	54.8	41.5	49.0
Hazard	51.7	58.4	54.4	55.2
Pocahontas	49.8	60.0	70.3	76.5
Tug River	48.1	63.7	74.0	83.6
Logan	47.6	61.1	68.5	73.3
Cumberland-Piedmont	46.6	50.6	10.7	17.5
Minging Gulf	45.7	64.3	65.6	73.4
Kenova-Thacker	38.2	54.3	71.1	83.1
N. E. Kentucky	32.9	47.7	56.5	59.3
New River‡	24.3	37.9	8.2	10.8
Union				
Oklahoma	63.9	59.6	17.6	15.0
Iowa	57.4	78.4	0.0	0.0
Ohio, north and central	52.6	46.6	0.0	0.0
Missouri	50.7	66.8	0.1	0.0
Illinois	44.8	54.5	0.0	0.0
Kansas	42.0	54.9	10.3	12.0
Indiana	41.4	53.8	0.0	0.0
Pitsburgh†	41.2	39.8	0.0	0.0
Central Pennsylvania	39.1	50.2	11.9	11.9
Fairmont	35.3	44.0	3.9	3.8
Western Kentucky	32.5	37.7	32.1	59.3
Pittsburgh*	30.4	31.9	0.0	0.0
Kanawha	26.0	13.0	1.0	2.1
Ohio, southern	22.9	24.3	0.0	0.0

* Rail and river mines combined.
† Rail mines.
‡ Union in 1921, non-union in 1922.

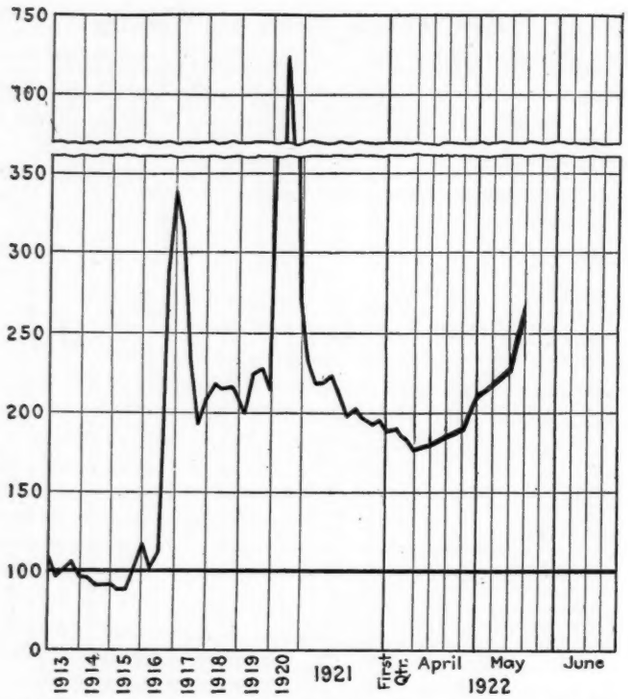
ANTHRACITE

Aside from a little coal dredged from the rivers, anthracite production continues at a standstill. There is next to no buying for the future by retail consumers and although yard stocks are getting low, the retailer turns a deaf ear to the meager offerings of replacement tonnage

Current Quotations—Spot Prices, Bituminous Coal—Net Tons, F. O. B. Mines

Low-Volatile, Eastern	Market Quoted	Apr. 17, 1922	May 1, 1922	May 8, 1922	May 15, 1922†
Smoke'ess lump	Columbus	$2.85	$3.05	$2.85	$2.75@$3.00
Smoke'ess mine run	Columbus	1.90	2.40	2.40	**2.75@$3.00**
Smoke'ess screenings	Columbus	1.40	1.75	2.20	**2.75@ 3.00**
Smoke'ess lump	Chicago	2.50	2.75	2.90	2.75@ 3.00
Smoke'ess mine run	Chicago	1.65	1.95	2.25	**2.50@ 2.75**
Smoke'ess lump	Cincinnati	2.35	2.90	2.90	**3.00@ 3.50**
Smoke'ess mine run	Cincinnati	1.70	2.15	2.60	**3.00@ 3.25**
Smoke'ess screenings	Cincinnati	1.60	2.15	2.40	**3.00@ 3.25**
*Smokeless mine run	Boston	4.75	5.05	5.65	**6.50@ 7.00**
Clearfield mine run	Boston	2.15	2.60	3.15	**3.00@ 3.50**
Cambria mine run	Boston	2.55	3.00	3.50	**3.50@ 4.00**
Somerset mine run	Boston	2.25	2.80	3.40	**3.25@ 3.75**
Pool 1 (Navy Standard)	New York	3.40	3.75	3.75	.....
Pool 1 (Navy Standard)	Philadelphia	3.15	3.70	3.75	**3.75@ 4.10**
Pool 1 (Navy Standard)	Baltimore	....	3.75	3.90	**3.75@ 4.25**
Pool 9 (Super. Low Vol.)	New York	3.25	3.25	3.50	**4.25@ 4.50**
Pool 9 (Super. Low Vol.)	Philadelphia	2.75	3.30	3.40	**3.50@ 4.00**
Pool 9 (Super. Low Vol.)	Baltimore	....	3.40	3.40	**3.75@ 4.25**
Pool 10 (H. Gr. Low Vol.)	New York	2.75	3.00	3.25	**4.25@ 4.50**
Pool 10 (H. Gr. Low Vol.)	Philadelphia	....	3.15	3.20	**3.40@ 3.75**
Pool 10 (H. Gr. Low Vol.)	Baltimore	....	3.25	3.25	**3.50@ 4.00**
Pool 11 (Low Vol.)	New York	2.75	2.75	3.00	**4.00@ 4.25**
Pool 11 (Low Vol.)	Philadelphia	2.25	2.80	2.85	.....
Pool 11 (Low Vol)	Baltimore	2.75	3.10	3.20	**3.25@ 3.75**
High-Volatile, Eastern					
Pool 54-64 (Gas and St.)	New York	2.90	2.70	2.70	**4.00@ 4.25**
Pool 54-64 (Gas and St.)	Philadelphia	2.15	2.50	2.65	.....
Pool 54-64 (Gas and St.)	Baltimore	2.90	3.00	3.00	.....
Kanawha lump	Columbus	2.30	2.90	3.15	3.00@ 3.25
Kanawha mine run	Columbus	1.60	2.65	2.65	**2.75@ 3.00**
Kanawha screenings	Columbus	1.50	2.00	2.20	**2.85@ 3.00**
W. Va. Splint lump	Cincinnati	2.00	2.75	2.50	**3.00@ 3.25**
W. Va. Gas lump	Cincinnati	1.75	2.75	2.90	**3.00@ 3.25**
W. Va. mine run	Cincinnati	1.90	2.40	2.70	**3.00@ 3.25**
W. Va. screenings	Cincinnati	1.70	2.20	2.50	**3.00@ 3.25**
Hocking lump	Columbus	2.65	3.05	3.15	3.00@ 3.25
Hocking mine run	Columbus	1.75	2.90	2.90	2.75@ 3.00
Hocking screenings	Columbus	1.50	2.15	2.25	**2.65@ 3.00**
Pitts. No. 8 lump	Cleveland	3.40	3.25	3.25	3.00@ 3.50
Pitts. No. 8 mine run	Cleveland	2.35	2.90	3.00	**3.00@$3.45**
Pitts. No. 8 screenings	Cleveland	2.20	2.90	3.00	**3.00@ 3.45**
Midwest					
Franklin, Ill. lump	Chicago	3.45	3.45	3.45	**3.65@ 4.25**
Franklin, Ill. mine run	Chicago	2.75	3.00	3.00	**4.00@ 4.25**
Franklin, Ill. screenings	Chicago	2.75	3.00	3.00	**4.00@ 4.25**
Central, Ill. lump	Chicago	....	2.75	2.75	.....
Central, Ill. mine run	Chicago	....	2.75	2.75	.....
Central, Ill. screenings	Chicago	....	2.00	2.00	.....
Ind. 4th Vein lump	Chicago	3.15	3.15	3.15	.....
Ind. 4th Vein mine run	Chicago	2.50	2.50	2.50	.....
Ind. 4th Vein screenings	Chicago	2.25	2.25	2.25	.....
Ind. 5th Vein lump	Chicago	2.60	2.60	2.60	.....
Ind. 5th Vein mine run	Chicago	2.60	2.60	2.60	.....
Ind. 5th Vein screenings	Chicago	2.40	2.40	2.40	.....
Standard lump	St. Louis	....	3.15	....	.....
Standard mine run	St. Louis	....	2.75	....	.....
Standard screenings	St. Louis	....	2.75	....	.....
West. Ky. lump	Louisville	2.35	2.60	2.90	**3.00@ 3.25**
West. Ky. mine run	Louisville	2.00	2.60	2.65	**3.00@ 3.25**
West. Ky. screenings	Louisville	1.90	2.60	2.65	**3.00@ 3.25**
South and Southwest					
Big Seam lump	Birmingham	2.00	2.00	2.00	1.95@ 2.10
Big Seam mine run	Birmingham	1.70	1.70	1.70	1.50@ 1.90
Big Seam (washed)	Birmingham	1.85	1.85	2.15	*1.75@ 2.15*
S. E. Ky. lump	Louisville	2.25	2.75	2.90	**2.75@ 3.50**
S. E. Ky. mine run	Louisville	1.75	2.75	2.80	**2.75@ 3.25**
S. E. Ky. screenings	Louisville	1.55	2.75	2.60	**2.75@ 3.25**
S. E. Ky. lump	Cincinnati	2.15	2.90	2.60	**3.00@ 3.25**
S. E. Ky. mine run	Cincinnati	1.90	2.40	2.60	**3.00@ 3.25**
S. E. Ky. screenings	Cincinnati	1.65	2.25	2.50	**3.00@ 3.25**
Kansas lump	Kansas City	4.25	4.25	4.25	4.00@ 4.50
Kansas mine run	Kansas City	4.00	4.15	4.15	4.00@ 4.25
Kansas screenings	Kansas City	2.50	2.65	2.65	2.50@ 2.75

*Gross tons, f.o.b. vessel, Hampton Roads.
†Advances over previous week shown in **heavy type**, declines in *italics*.
Note—Smoke'ess prices now include New River and Pocahontas.



Coal Age Index 261, Week of May 15, 1922. Average spot price for same period, $3.16. This diagram shows the relative, not the actual, prices on fourteen coals, representative of nearly 90 per cent of the total output of the United States, weighted in accordance first with respect to the proportions each of slack, prepared and run-of-mine normally shipped and second, with respect to the tonnage of each normally produced. The average thus obtained was compared with the average for the twelve months ended June, 1914, as 100, after the manner adopted in the report on "Prices of Coal and Coke, 1913-1918," published by the Geological Survey and the War Industries Board. (Pittsburgh, Standard, Indiana and Central Illinois prices not included in figures for last week.)

at the high premiums quoted. Pea coal is still long, both at retail and wholesale. Steam grades are very scarce, with the exception of buckwheat, and one company producer is now conserving the supply of this size.

COKE

Beehive coke production showed a slight gain during the fifth week of the strike. The output was 90,000 net tons as compared with 89 000 tons in the previous week, a slight decrease in the Connellsville section being offset by increases in other districts.

The demand for coke is so strong that a large tonnage stored in New Jersey by the Seaboard Byproducts Coke Corpn. has been purchased by Pittsburgh steel interests.

Despite the coal strike the output of byproduct coke increased again in April. The total production for the month was 2,227,000 net tons, an average of 74,244 tons per day. In comparison with the daily average for March, this was an increase of 8 per cent. The month's production even exceeded the monthly average for any year prior to 1920.

MONTHLY OUTPUT OF BYPRODUCT AND BEEHIVE COKE IN THE UNITED STATES (*a*)
(Net Tons)

	Byproduct Coke	Beehive Coke	Total
1917 Monthly average	1,870,000	2,764,000	4,634,000
1918 Monthly average	2,166,000	2,540,000	4,706,000
1919 Monthly average	2,095,000	1,638,000	3,733,000
1920 Monthly average	2,565,000	1,748,000	4,313,000
1921 Monthly average	1,660,000	463,000	2,123,000
February, 1922	1,795,000	549,000	2,344,000
March, 1922	2,137,000	732,000	2,869,000
April, 1922	2,227,000	528,000	2,755,000

(*a*) Excludes screening and breeze.

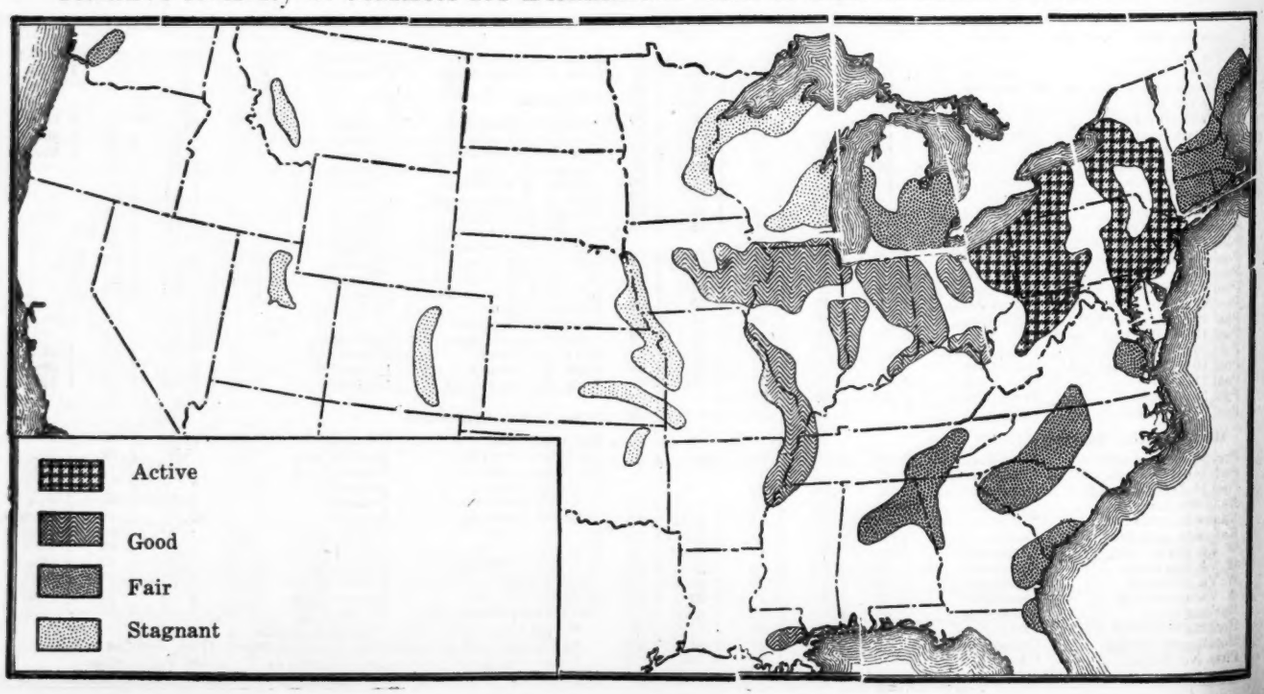
The monthly consumption of coal for coke manufacture has now definitely passed the 4,000,000-ton mark. In April, it is estimated, 4,033,000 tons were required by the ovens, an increase of nearly a million tons over the 1921 average. The market for coking coal is still far below normal, as seen from the fact that the present monthly requirements of the coke industry are only 57 per cent of those in the war period, and only 73 per cent of the average in 1919.

ESTIMATED MONTHLY CONSUMPTION OF COAL FOR MANUFACTURE OF COKE
(Net Tons)

	Consumed in Byproduct Ovens	Consumed in Beehive Ovens	Total Coal Consumed
1917 Monthly average	2,625,000	4,354,000	6,979,000
1918 Monthly average	3,072,000	4,014,000	7,086,000
1919 Monthly average	2,988,000	2,478,000	5,466,000
1920 Monthly average	3,684,000	2,665,000	6,349,000
1921 Monthly average	2,385,000*a*	731,000*a*	3,116,000
February, 1922	2,579,000*a*	866,000*a*	3,445,000
March, 1922	3,071,000*a*	1,155,000*a*	4,226,000
April, 1922	3,200,000*a*	833,000*a*	4,033,000

(*a*) Assuming a yield in merchantable coke of 69.6 per cent of the coal charged in by-product ovens, and 63.4 per cent in beehive ovens.

Relative Activity of Markets for Bituminous Coal at End of Sixth Week of Strike



Foreign Market And Export News

British Coal Output Highest Since 1920; Export Market Conditions Improve

BRITISH production touched the high point for the year during the week ended April 29. The output was 5,160,000 gross tons, according to a cable to *Coal Age*, as compared with only 3,544,000 tons during the previous week, when production was curtailer by Easter holidays.

Information from the majority of the Welsh pits indicates that order-books are pretty well filled, while for some of the better classes of coal the supplies are not enough to meet the demand. Some urgent calls for the best classes of coal have been received from South America, though the quantities and origin of the calls are not so far disclosed. Other demands are being received from Italy, France and India, while calls from Central America are anticipated.

The certificate issued by the joint accountant for the audit of the South Wales coal trade for February indicates that, after deducting the owners' 17 per cent of profits, the percentage on the 1915 standard which can be paid by the industry amounts to 9.13 per cent, and that the surplus available is £46,043. During February profits were again too small to pay the minimum of 28 per cent above the standard. The owners have had to sacrifice their share of this surplus and also pay an additional £3.000; thus under the agreement terms they lose £284,000 during February.

In Scotland the trade is very much the same. There is no appreciable improvement in the home trade, though here and there slightly heavier demands are reported. The export trade is about the same with slightly increased demands from the Continent.

An encouraging feature of the Welsh trade is that the coal trimmers and trippers engaged at the Welsh ports have offered to work a full 8-hour day, and also to extend both daily shifts by a half-hour so as to allow a spell of 30 minutes for meals. The effect of this is to make available a full 16-hour day for coal loading, and conservative opinion estimates that this will permit a 15 per cent increase in exports.

Heavy Demand Cuts Supply at Roads

Activities dropped off last week, with dumpings about 25 per cent below the previous weeks of the coal strike, and with prices steadily moving upward. Movement of coal to New England was not up to normal, although bunker and export business was holding its own.

Increases started on high-volatiles, the supply of which has steadily diminished. It was followed by raise on all grades. Supplies of low-volatile coals are slightly diminished, and in other grades are far below normal.

Shipments to New York are moving fairly well. Active demand from other sections is reducing the pier supply, however.

Many union mines served by the Chesapeake & Ohio are not in operation, and supplies at Newport News are being cut down. Only to a very slight extent was this true of the fields in which the Norfolk & Western and the Virginian railways operate.

March Exports by Customs Districts

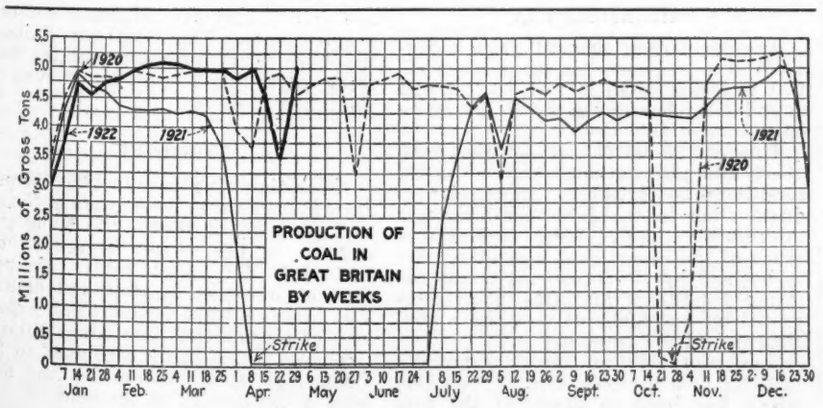
(GROSS TONS)	March, 1922
Maine and New Hampshire	1,124
St. Lawrence	287,217
Rochester	55,072
Buffalo	425,836
New York	64
Philadelphia	20,022
Maryland	19,339
Virginia	140,609
South Carolina	13,038
Florida	18,384
Mobile	673
New Orleans	1,315
Sabine	38
Galveston	2
El Paso	6,151
San Diego	12
Arizona	737
San Francisco	919
Washington	736
Dakota	1,953
Duluth and Superior	5,938
Michigan	153,085
Ohio	35,049
Total	1,187,313

Coal Paragraphs from Foreign Lands

ITALY—The price of Cardiff steam first is now 41s. 3d., according to a cable to *Coal Age*, a drop of 1s. from last week.

Imports for March were 2,006 tons from the United States, 614,000 from the United Kingdom, and 260,000 from Germany. Following the strike of the port laborers a large quantity of coal has accumulated at Genoa, causing a decline in prices, although British prices are firm on account of the American strike. The big decline in American coal is due to inability to meet British prices and credits.

GERMANY—Production in the Ruhr region during the week ended April 29 was 1,911,000 metric tons, according to a cable to *Coal Age*, as compared with 1,525,000 tons during the preceding week.



Hampton Roads Pier Situation

	—Week Ended— May 4	May 11
N. & W. Piers, Lamberts Point:		
Cars on hand	2,141	1,367
Tons on hand	119,620	73,444
Tons dumped	201,641	166,089
Tonnage waiting	15,000	10,000
Virginia Ry. Piers, Sewalls Point:		
Cars on hand	973	1,084
Tons on hand	48,650	54,200
Tons dumped	122,391	90,558
Tonnage waiting	10,757	31,650
C. & O. Piers, Newport News:		
Cars on hand	642	602
Tons on hand	32,100	30,100
Tons dumped	63,433	50,882
Tonnage waiting	4,290	8,300

Export Clearances, Week Ended, May 11, 1922

FROM HAMPTON ROADS:

	Tons
For Atlantic Islands:	
Br. Schr. Thuro Queen, for Charlotte town	657
Am. S.S. Cristobal, for Cristobal	6,477
Nor. S.S. Hallgjerd, for Curacao	2,131
Nor. S.S. Belita, for Kingston	844
For Brazil:	
Br. S.S. Boswell, for Buenos Aires	2,291
Braz. S.S. Camamu, for Rio de Janeiro	6,226
For Cuba:	
Am. Schr. Anandale, for Cienfuegos	2,440
Nor. S.S. Christian Michelson, for Havana	5,544

Pier and Bunker Prices, Gross Tons

PIERS	May 6	May 13†
Pool 9, New York	$6.25@$6.50	**$8.00@$8.50**
Pool 10, New York	6.15@ 6.35	**8.00@ 8.25**
Pool 9, Philadelphia	6.30@ 6.55	**6.55@ 7.00**
Pool 10, Philadelphia	6.00@ 6.35	**6.40@ 6.75**
Pool 71, Philadelphia	6.50@ 6.80	**6.90@ 7.30**
Pool 1, Hamp. Rds	5.30@ 5.80	**6.50@ 7.00**
Pools 5-6-7 Hamp. Rds	5.50	**6.50@ 7.00**
Pool 2, Hamp. Rds	4.95@ 5.15	**6.00@ 6.50**
BUNKERS		
Pool 9, New York	$6.60@$6.80	**$7.50@$7.75**
Pool 10, New York	6.45@ 6.65	**7.25@ 7.50**
Pool 9, Philadelphia	6.50@ 6.75	**6.85@ 7.30**
Pool 10, Philadelphia	6.15@ 6.60	**6.80@ 7.00**
Pool 1, Hamp. Rds	5.90	**7.00@ 7.25**
Pool 2, Hamp. Rds	5.25	**6.40@ 7.00**
Welsh, Gibraltar	43s. f.o.b.	43s. f.o.b.
Welsh, Rio de Janeiro	55s. f.o.b.	55s. f.o.b.
Welsh, Lisbon	43s. f.o.b.	43s. f.o.b.
Welsh, La Plata	50s. f.o.b.	50s. f.o.b.
Welsh, Genoa	43s. t.i.b.	43s. t.i.b.
Welsh, Messina	38s. f.o.b.	41s. f.o.b.
Welsh, Algiers	41s. f.o.b.	41s. f.o.b.
Welsh, Pernambuco	62s. 6d. f.o.b.	62s. 6d. f.o.b.
Welsh, Bahia	62s. 6d. f.o.b.	62s. 6d. f.o.b.
Welsh, Madeira	42s. 6d. f.a.s.	42s. 6d. f.a.s.
Welsh, Teneriffe	40s. 6d. f.a.s.	40s. 6d. f.a.s.
Welsh, Malta	44s. 6d. f.o.b.	44s. 6d. f.o.b.
Welsh, Las Palmas	40s. 6d. f.a.s.	40s. 6d. f.a.s.
Welsh, Naples	38s. f.o.b.	38s. f.o.b.
Welsh, Rosario	52s. 6d. f.o.b.	52s. 6d. f.o.b.
Welsh, Singapore	57s. 6d. f.o.b.	57s. 6d. f.o.b.
Port Said	46s. 6d. f.o.b.	46s. 6d. f.o.b
Alexandria	*44s.*	44s.
Capetown	35s. 3d.	35s. 3d.

Current Quotations British Coal f.o.b. Port, Gross Tons

Foreign Quotations by Cable to Coal Age

Cardiff:	May 6	May 13†
Admiralty, Large	28s6d@28s9d	**28s6d@29s**
Steam, Smalls	19s@20s.	19s@20s.
Newcastle:		
Best Steams	23s@24s.	**23s6d@24s.**
Best Gas	24s.	*23s@24s.*
Best Bunkers	22s 6d.	22s 6d.

†Advances over previous week shown in **heavy type**; declines in *italics*

North Atlantic

Big Users Snap Up Output at Mines; Good Coal off Market

Quotations Rising Steadily — Pennsylvania Grades Scarce, Southern Fuels Flow In—Railroads Transship Latter from New York.

BALTIMORE reports a general scramble for coal and an actual shortage of offerings. Good coal is practically off the market, as large users are snapping up all tonnage at the mines as fast as it is loaded. Prices continue their upward trend throughout this territory.

Pennsylvania grades are very scarce and the influx of Southern coals is the feature of the week. Early last week the price began to advance in sympathy with the stronger demand in other sections until Southern coal is now quoted on a basis of around $7, f.o.b. the Roads. Railroads are reloading this coal into cars at New York Harbor while at Baltimore it is being put into cars for transshipment to Pennsylvania rail points.

NEW YORK

With demand increasing the situation is not growing brighter. Cars at the local loading piers number about half as many as a week ago, while consumers who refused to add to their reserve stocks when coal was plentiful and prices low are now making numerous inquiries.

Quotations show more strength than last week but so far there has not been a tendency to go sky-high. Considerable of the Southern coal is being diverted to the West, which caused prices to advance. This increase was reflected here and also resulted in a stiffening of quotations for Pennsylvania coals.

Southern coals are not coming forward as heavily as a few weeks back. Quotations ranged $7.50@$7.75, alongside, although these figures were slightly shaded earlier in the week.

Some railroads are shipping Southern coals to this harbor and after reloading it into cars are sending it to points along their roads for their own use. Dealers who have coal ready for immediate shipment do not have much trouble in disposing of it if the price is right, the buyer not questioning to any great extent the quality. Hesitancy, however lost a cargo to many a consumer last week.

BALTIMORE

Careful reviews of the districts usually shipping to Baltimore show decreased production so that the entire situation shows a growing tendency toward tightness. Some of the Pennsylvania fields are running by paying bonuses and holding their men at work in that way.

With prices for even the poorest classes of coals running $3.75@$4.25, and best classes of steam coals almost impossible to secure, except on a new routing by water up the Chesapeake Bay from the Virginia connections, a genuine scramble is on for fuel protection. The production of high-grade steam has decreased to such an extent, that except on contract movement from producers who are determined to maintain regular customers' deliveries if possible, there is no outside offering of moment.

Following a few considerable shipment of New River and Pocahontas coals from Hampton Roads, has come a fairly steady stream of ships, and barges, principally with Pocahontas. One active dealer here leased a city pier on the harbor front in the heart of the business district and has been barging in large quantities of Pocahontas. Some of the coal dumped on the municipal pier by this shipper has been used by local consumers who carted from the pier, and some has been hauled for transshipment to Pennsylvania rail points.

CENTRAL PENNSYLVANIA

The strike situation at the close of the sixth week shows no unusual developments. The U. M. W. is still actively engaged in organizing the miners who remain at work. During the past week the miners of Nos. 1, 2 and 3 of the Consolidated Coal Co., at Myersdale, Somerset County, were organized.

The entire field produced 2,437 cars during last week as compared with 2,245 cars the previous week. Prices have advanced. Pool 10, one of the leading coals of the field, is now bringing $3.50 at the mines. The demand for coal is on the increase from line points.

UPPER POTOMAC

Material improvement in conditions in the Upper Potomac is seen, with about half of the mines in operation. Additional mines are resuming operations every day. Pools 10 and 11 are bringing $2.75@$3. Although men in the Georges Creek field are becoming more anxious to return to work, there has been no general break away from the union so far.

PHILADELPHIA

Another strong upward price movement is in evidence. It takes much effort to locate small lots of Pools 1 and 9, and many houses simply do not quote on grades of this kind at all.

Toward the latter part of the week there was just the least sign of easier conditions, not due to any increased production but to the fact that consumer interest decreased. Much capital was made of the report that a meeting was to be held by the President to discuss strike conditions and this was interpreted by the public as meaning a possible end of the trouble.

Many consumers are speaking strongly in favor of a seasonal freight reduction which has been so much to the fore recently. It is really remarkable even under the present scarcity of coal how the buyer is still inclined to limit necessary purchases predicated on a reduced freight in the near future.

There is practically no coal being loaded for export at the piers, as it is a rare thing these days to have a cargo clear. For such bunkering as offers the demand is easily met.

FAIRMONT

Steady gains are being recorded in the number of mines at work. Many of these are smaller mines which have been out of commission for a year and a half. Mines in the larger communities are not in operation. Miners are becoming restless, however, owing to a shortage of funds and lack of relief accorded them and are now seeking work in mines where they are not known. The demand is in excess of the supply.

South

BIRMINGHAM

A considerable quantity of Alabama coal has been sold for shipment through the Memphis gateway during the past week, principally for railway use, the Missouri Pacific placing orders for 20,000 tons, prompt shipment, and the Mobile & Ohio for some tonnage. Inquiries were also received from industrial consumers and domestic dealers in the West. With the exhaustion of present stocks and the continuation of the strike Alabama will shortly be called upon to supply consumers who will be cut off by the movement north and west from Kentucky and West Virginia.

Several thousand tons of coal moved to seaboard the past week for shipment to South America. The coke market has developed strength in the past week or two, a heavy tonnage going into the St. Louis and Kansas City territory and several thousand tons were exported. Railroad contracts closed recently called for approximately three million tons for delivery during the next twelve months.

Domestic mines are having some trouble in disposing of the output, although production is on a limited scale. Prices of steam coal have not been affected by increased business and more active inquiry so far and are shown in the Weekly Review.

Production is on a basis of about 275,000 tons per week. Railroads having contracts in the district are not stocking any coal at present and in most cases are only taking the minimum contract requirements. The Southern Railway has been short on equipment the past week, curtailing the output at some of the mines it serves.

VIRGINIA

At no time since late in 1920 has production been on so large a scale. Nearly 83.2 per cent of capacity is being produced. In the section served by the C. C. & O. it is 94 per cent. Coke production, however, is somewhat limited. The larger output is due to an expansion of the markets into which Virgina coal goes, some being consigned to the Pittsburgh steel center, for the first time in the history of the field.

Anthracite

Weather Aids, Winter Price Schedule Retards, Demand

Yard Stocks Gradually Fade—Premium on Independent Offerings Limits Trading—Buckwheat Moving Better; Plenty Still to Be Had—Lake Market Inactive.

BACKWARD spring weather has prolonged a little current demand. No one will buy in quantity, however, with the full winter retail schedule in effect. Yard stocks are going down very gradually and dealers are in good position to refill when new mining conditions become effective. Some independent coal is still offering in small lots, but the premium is too high and trading is very light.

Buckwheat is practically the only steam size available and there is some betterment in the demand for this by the anthracite railroads. The scarcity of soft coal is moving more buckwheat, but there is still plenty of this tonnage available, and stocks will stand a heavy drain. The Lake market remains inactive, both at the lower ports and at the Head-of-the-Lakes.

BOSTON

For the most part, dealers are marking time. The householder who is putting in next season's coal is very much the exception; the public as a whole seems not interested.

City dealers have moderate stocks for several weeks to come at the present rate of delivery but a rush on the part of consumers would absorb present reserves in a comparatively short period. A few retailers in country places are out of certain sizes already and are making inquiry for deliveries "when mining is resumed."

One small but significant move is the advance in Boston at retail of pea coal, the new price being $12, effective May 13. The previous figure was $10.50.

PHILADELPHIA

The backward spring serves to give the retailer some little business, but this is not sufficient to create any real activity. While some yards are almost entirely out of stove and nut, there are others who claim at the present rate of movement to have sufficient to carry them to July 1.

With the full winter retail schedule prevailing no one wants coal in quantity. The lack of demand, even by the retailer, is shown by the offer of some storage chestnut by local brokerage houses. This is freely offered at $8.50, occasionally at $8.40, yet sales are few.

Much of the correspondence of shipping houses these days is from customers inquiring as to the duration of the suspension, which is generally met with the stereotyped answer that no one knows.

There are some signs of betterment in the steam trade, which really means buckwheat coal, as barley is all gone, and rice almost so. The soft coal situation is beginning to make just the slightest impression, and the anthracite railroads seem to be making heavier requisitions.

BALTIMORE

The hard coal situation is at a standstill. The only feature is that more and more of the smaller yards are running out of supplies. Dealers here who figure that the strike will go on for at least another month, are beginning to have serious doubts of the ability of local retail handlers to meet the rush conditions that are bound to come on next fall.

BUFFALO

Some of the largest distributors have no coal at all and are merely sending out circulars, soliciting orders, to be filled when new coal comes in. Consumers generally have what coal they expect to need until mining is resumed. The idea seems to be that prices will be lower then.

Some effort has been made to sell the steam sizes that most operating companies have on hand, but the demand is small. It appears that manufacturers are able to get what bituminous they want and do not care for anthracite at any price.

Some independent anthracite is moving, but the demand for it is even lighter than for regular coal, for the premium on it is a dollar or so, with some concerns asking more.

ANTHRACITE FIELDS

Conditions are still quiet in the region. Many workers would agree to go back at the old scale and a few would be willing to take a small cut in wages. In parts where work was not so plentiful last year the men are feeling the suspension badly. Restlessness seems to be increasing on the part of the men, who apparently feel that a contract should either be signed or else a regular strike be declared. There is a growing feeling, however, that an early settlement would be more desirable than the declaration of a strike.

NEW YORK

Dealers are beginning to enter the buyers' market. Their stocks are being rapidly depleted, and with no indications that the miners will return to work shortly it is becoming more apparent that New Yorkers will soon realize that production is at a standstill.

The supply of stove is nearly exhausted with wholesalers as well as retail dealers. There are small tonnages of egg and chestnut to be had, most of which is in boats but so far there has not been any urgent demand for these coals.

Pea coal is about the only size producers have in stock. Conditions have not yet become serious enough where consumers are willing to take this size rather than go without. Quotations heard for domestic coals are generally on the alongside basis.

Steam coals are not moving quickly. At least one company is conserving its supply of buckwheat. Quotations for rice in some quarters ranged $5.50@$5.75, alongside, and barley was about $1 less.

Coke

UNIONTOWN

A substantial gain in the movement of coal and coke in the Connellsville region is shown for the week ended May 13. Coal shipments were 2,084 cars as against 1,808 the previous week. Coke shipments were 1,015 cars compared with 979 the previous week. The output of the region for the week may be estimated at 103,700 tons of coal and 50,750 of coke.

Generally the strike situation itself has shown no material change. On Monday the Calumet mine of the H. C. Frick Coke Co. resumed operations, marking the first break of any proportion in the strike. Several acts of violence also marked the week.

The market is steady and rising but not feverishly. The report of coal reserves created by steel interests in the Pittsburgh district from West Virginia and Kentucky fields have had a heartening effect. Grades of steam coal are quoted at $3.10@$3.25 and byproduct $3.25@$3.40.

CONNELLSVILLE

Connellsville furnace coke is up 25c., being quotable at $6.50, foundry coke being unchanged at $6.75. Offerings are very light for both grades, but demand is also light. It is only in exceptional circumstances that a blast furnace will buy coke at anything like current prices, while other consumers, who buy only an occasional carload, do not count cost so carefully.

Production is running at about one-third the rate of March, with no prospects of any material change in either direction in the next few weeks. For furnaces normally tributary to the Connellsville region coke is being obtained from unusual sources, including Alabama, while the byproduct ovens that ordinarily use Connellsville coal are drawing from several fields, including those in West Virginia and Kentucky. The Carnegie Steel Co., which was operating 34 blast furnaces April 1 and 32 in the past few weeks, is resuming operations at two Mingo stacks.

The *Courier* reports production in the week ended May 6 at 38,500 tons by the furnace ovens, and 13,700 tons by the merchant ovens, making a total of 52,200 tons, a decrease of 2,030 tons.

BUFFALO

The trade is not much more than nominal, as the beehive ovens have practically no coke to sell. Local furnaces are running more actively than they were, but they are pretty well supplied. When they do give out an order they pay $6.50@$7 for 72-hr. Connellsville foundry $5.50@$6 for 48-hr. furnace and $4 for stock.

Chicago and Midwest

Railroads Plan Pool To Buy Coal For Them

Scheme Is Expected to Protect Lines Against Skyrocketing Prices — All Quotations Climb Steadily—Fields in West Have Few No-Bills Left.

THE most important development in the Midwest region during the past few days, from the coal marketing standpoint, was the opening of negotiations among railroads which will result in the formation of a sort of buying pool. By a method yet to be worked out the railroads hope to go quietly into the Kentucky and Eastern fields and buy regularly and in moderate quantities during the remainder of the strike period. They are working out their plan in self defense against skyrocketing prices, believing that those roads which have been buying more or less openly during the past ten days through regular channels, are partially responsible for the hike prices Kentucky coals have taken.

Kentucky continues to play the leading role in the Midwest. Its eastern non-union fields and its western fields that are still paying the union scale under an agreement running the rest of the year, are producing heavily and selling at practically their own figure. In both cases little sizing is done, unless buyers insist upon it—and pay for the preparation. Quotations in both fields at the end of last week were about the same, running around $3.25 for mine run. In the case of western Kentucky, this represented an increase of 50c. or more above the price of the week before and the level was constantly ascending.

Demand for these coals, while not keen around Chicago, is better than it was a week ago when the prices irritated buyers in that district to such an extent that they refused to get interested, and as a result, a good deal of western Kentucky coal got into distress and was unloaded at a loss. The congestion has all been absorbed and many sales of small lots were going at $3.25@$3.50 at the close of last week. The only big deal reported near Chicago was that of a public utility which took 300 cars at $3.35. The flow of Kentucky coals north has been steady and growing for two weeks so that the operators are happy, even though many of those in the western end of the state are condemned generally by buyers for unprincipled tactics and for cupidity which may bring down Government intervention.

Indiana and Illinois fields are cleaned out except for a little sized coal in Franklin County and a moderate quantity of steam sizes in the territory just east of St. Louis. The prices on these fag-ends have risen noticeably.

Domestic trade amounts to almost nothing. A few dealers are taking a little fuel, especially smokeless lump, which they expect to hold for a class of household trade which ordinarily buys anthracite in August and September.

CHICAGO

A slight freshening of the market was noticeable during the past week. A number of concerns actually were busy selling coal for the first time since the miners struck. This does not mean that the market is strong. It simply means enough buyers were in for small quantities to interest several of the much reduced selling staffs, indicating that disappearing stocks in the yards of big consumers and public utilities are drawing more and more purchasing agents back into action.

Most of the trading nowadays is in Kentucky coals, though a little smokeless dribbles into this market regularly at a slightly improved price. Smokeless lump has not passed $3 but mine run has picked up a little and can hardly be bought under $2.50 at any time. Kentucky fields are making money, evidently, and there now seems to be sufficient demand in this region for western Kentucky mine run, even at the stiff price of $3.35, to prevent a recurrence of the congestion of distress coal from that field which afflicted Chicago ten days ago when coal bought at the mines for $2.60@$2.75 was sold here for as low as $2.35.

The swift and steady rise of this fuel is causing a good deal of apprehension here. Many observers of the coal trade feel that if the climb continues it will invite Government intervention in the strike. Eastern Kentucky coal is quoted just as high. It is pointed out, however, that the price is still 25c.@50c. below that fixed as fair by the Garfield fuel administration.

Southern Illinois coals will figure in the market for only a few days more. At the close of last week there were less than 500 cars of no-bills available of which only a handful contained screenings for which owners were trying to get at least $4.25 and the balance was sized coal selling in small lots all the way from $3.65, which was the top price for all of April and part of May, up to $4.25. Northern Illinois Springfield district and Indiana fuels are out of this market. There remains some Mt. Olive and Standard district coal, however.

SOUTHERN ILLINOIS

Practically all the coal in the Williamson and Franklin County field is cleaned up. Conditions there and in the Duquoin and East Jackson County fields are quiet, with the exception of a little disturbance reported near Johnston City. In the Mt. Olive district some commercial coal is still on hand and considerable railroad coal is moving out.

There is still considerable coal left in the Standard district especially at mines near East St. Louis and Belleville. It is being loaded out partially by truck.

ST. LOUIS

A few plants in this region are getting into their storage coal and are inquiring about some future supplies. The railroads are buying a little, especially the Wabash, Frisco and Terminal. There are still several thousand tons of coal in St. Louis in storage. There is at the mines in Illinois within trucking distance several thousand tons of steam sizes and several thousand tons additional are stored at mines in Illinois. But the demand right now is insignificant.

The methods of the west Kentucky operators are astounding St. Louis coal men. Many of these shippers repudiate their earlier sales in order to handle the higher priced ones that come in later. Some of the coal coming into the St. Louis market is the commonest kind of junk. A week ago western Kentucky mine run was $2.50. Now it is $3.50 with lump $4@$4.50. These tactics are the sort that call for government interference.

LOUISVILLE

Prices have advanced about 50c. a ton on some grades of coal in the state over the week end. Producers quote only on immediate delivery. Better buying of railroads, steel, utilities, etc. is noticeable, most of the demand coming from the North. There is practically no Southern business except on railroad fuel.

Coal prices start at $3 in western Kentucky for screenings and mine run, while in eastern Kentucky some mine run is quoted at $3.25, and some lump $3.50@$3.75. Lake movement is picking up steadily, and numerous orders are coming from Chicago, Detroit, Youngstown, Cleveland, Columbus, and inquiries from as far as Buffalo, Pittsburgh and Philadelphia.

INDIANAPOLIS

Indianapolis industries, domestic consumers and public utilities are supplied with coal sufficient to last until cold weather. There is some inquiry, but little actual demand. The Pennsylvania, with its five divisions out of Indianapolis, appears to be the hardest hit. Officials of the road say they have 25,000 tons on hand and about 600 cars on one division, but the company apparently is in the market.

WESTERN KENTUCKY

Western Kentucky after losing money most of the past six months paying peak prices for labor, and selling coal in competition with the 1917 scale of wages in eastern Kentucky, today is "sitting pretty" and getting business. In spite of the fact that western Kentucky is still paying the peak scale, under the pre-strike contract with its miners, whereas the eastern Kentucky non-union field is on the 1917 basis, prices have advanced sufficiently to allow western Kentucky to compete.

Some complaint has been heard concerning operators who fail to fill old orders. Most operators went into the strike period with very little contract or old business, and have refused to accept business for more than a week or ten day period at most. Many are taking orders practically from day to day thus keeping up with the market all the time.

Northwest

Upper Lake Territory Calm and Indifferent

Coal Consumers Show Little Interest in Fuel—Prices Remain Sweet and Low—Shipments to and from Docks Far Lighter Than Normal.

THE Northwest remains generally indifferent to the strike. Prices are still soft and give no indication of stiffening as they have done in almost every other section of the country. Industry is not forging ahead. Many development plans have been laid aside awaiting some sort of settlement both of the differences of opinion between miners and operators and of freight rates.

Some immediate encouragement may have been given to those who confidently expect freight rates to go down by the reductions lately put into effect on coal from some of the Wisconsin docks to Inland points. Already a protest against this reduction has been formulated by traffic organizations in Illinois who claim it is unfair to all-rail coal.

MILWAUKEE

Little can be said of the coal market, other than that it is practically dead. What movement there is is confined to soft coal, of which there is no shortage as yet. The anthracite situation is more tense, but there is little of this coal consumed at this time, and nobody is ordering for future delivery.

Buyers in the Eastern soft-coal fields report a tendency to stiffen prices. But a reduction was made here during the past week of 50c. per ton on Eastern soft coal and also on smokeless from West Virginia. Pocahontas mine run for steaming purposes sells at $7 per ton and screened Pocahontas at $10. Pittsburgh and Youghiogheny coal for domestic use is listed at $8.75, and for steam at $7.50.

Coal arrivals by Lake during May thus far number seven cargoes of soft coal, aggregating 48,634 tons, making the receipts this season 8,000 tons of anthracite, and 148,943 tons of soft coal. Last year during the same period 139,522 tons of anthracite, and 303,190 tons of soft coal were received over the docks.

DULUTH

Fears of a cut in railroad rates have far outbalanced any fear of a coal shortage at the Head-of-the-Lakes, and buyers are holding off consistently for the drop which they know must come if the railroad reduction materializes. The coal trade here is distinctly in the doldrums.

The general industrial situation is not promising, as many concerns which announced their openings, have withdrawn their announcement pending the settlement of the coal strike. This does not apply to the steel industry at Duluth, which has already contracted for its coal.

Bituminous tonnage on docks as of May 1 is placed at 2,841,189, a decrease of 334,000 tons from figures of April 1, and anthracite is at 416,464 tons, which is but 12,986 tons less than at April 1. Since the figures were compiled 61,000 tons of soft and 5,000 tons of hard coal have been received.

The bituminous market is weaker than at any time since the first of the year. Prices are $6.50 for lump, $6 for run of pile and $4.25@$4.75 for screenings. Although this represents a drop of 50c. from the list, some docks are shading even further to obtain orders.

Reports still persist that a ship will load at Duluth within a few days for South Chicago, marking the first shipment of coal from the Head-of-the-Lakes to a point nearer the mines.

MINNEAPOLIS

If the striking miners thought to frighten anyone into frantic appeals for fuel, their hopes have not been in the slightest successful in this territory. Consumers seem to be entirely oblivious to there being any such thing as a coal strike.

Prices are weak and uncertain. There are some intimations that a little tonnage is being placed now and then, quite secretly. Railroads are understood to be adding a little to their contracts, where it can be done without publicity. The sentiment seems to be that as a reduction is almost certain to follow the adjustment of the mine wage difficulties, it may be as well to get prices down now. However, this does not stimulate business.

The industrial requirements continue to be light. The flour mills and electric light and street railway plants which have water power, have been able to keep their steam plants running at a very low rate. Other industrial requirements have been considerably less than normal.

Stocks of soft coal on the docks will serve for several months without difficulty, but might leave the docks bare in the fall if a rush comes from all directions. Then it would be too late to restock in sufficient quantity for the following winter. But no one seems to worry about what will happen next winter.

One thing which tends to make everyone wait that possibly can, is the recurrence of hints that freights are about due for a reduction. Whence these rumors come, is not clear, and whether there is anything in them is equally uncertain. But they exist, and many people listen carefully and obey them.

New England

Roads Call Equals Supply; Prices Make Rapid Advance

Rise Is the Sharpest New England Has Seen in Two Years—Distress Coal in Harbor Cleaned Up—Spot Demand Negligible, but Buyers May Be Stampeded.

HAMPTON ROADS demand has overtaken the supply and prices have advanced rapidly. New England quotations have risen more rapidly than at any time during the last two years. Prices will continue to advance and will be limited only by the amount certain buyers will pay.

Distress coal in Boston Harbor has been cleaned up, and although there is no particular spot demand, it is quite possible that the rising market will scare some buyers into taking more coal. The West and New York seem to be bidding for the current smokeless output and this indicates a smaller movement here in the near future. Central Pennsylvania coals are so scarce and high-priced that but little tonnage is coming in.

The past week has shown a succession of rapid advances such as we have not seen for nearly two years. On May 10 sales of Pocahontas were reported at $5.90 per gross ton f.o.b. vessel at Norfolk, while the next day there were few quotations at less than $6.50. At this writing $7 is rumored and $8.50 has been quoted on cars Boston for Inland distribution. There is trade comment on the effect this flurry is likely to have on organized labor at a time when there is a strong public sentiment in favor of reduced prices.

There is no question now that demand at Hampton Roads has overtaken supply. Apparently there is an active enough market in the West to keep prices very firm and there is also a more or less insistent demand on the part of Pennsylvania shippers who have commitments in New York Harbor. It seems a clear case of the West and New York bidding against each other for current output in the smokeless region.

Pennsylvania production is extremely light, and quotations range much higher all along the line than was the case a week ago. Very little tonnage is dribbling through all-rail, but here and there shippers are offeringing scattered lots for shipment to the Philadelphia and New York piers.

"Distress" coal in Boston Harbor has now been absorbed and while current quotations are on a much higher level there is no particular demand for spot coal that will send prices up as fast as they have advanced at the Roads.

It is likely coastwise movement to New England will fall off materially. A medium large tonnage will of course continue coming forward on contracts, but spot sales probably will for the present be rather few in number.

Eastern Inland

Buying of West Virginia and Kentucky Coals Livens Market

General Demand Better, with Steel Mills and Railroads Heaviest Takers —Market Trends Steadily Up, Receipts Gaining Daily—Lake Coal Travels New Routes.

HEAVY buying of Kentucky and West Virginia non-union coals has made an active market. The steel industry and railroads are the heaviest takers but the general demand also is more brisk as business continues to recover and buying for replenishment of stockpiles is growing. The production of steel increased during April, despite the curtailment of fuel supplies, caused by the strike. The trend of the market is steadily upward and receipts are now increasing daily.

Lake coal is moving over new and unaccustomed routes. Caused by the industrial demand at Buffalo and other lower ports, the Cross-Lake movement of coal has temporarily stopped coal traffic up the Lakes.

CLEVELAND

Indications of a brisker demand for coal are becoming clearer as business recovery becomes more pronounced and stocks of fuel dwindle. At the present time it is estimated that 65 per cent of the mines in the non-union districts in the Central West are producing. As demand grows more keen and prices increase this ratio will be increased, it is believed.

Little coal is coming into the ports east of Sandusky. The loading for the first nine days of May was much smaller than the corresponding period of last year. The bulk of the coal loaded at lower ports is being diverted to Buffalo. As a result of the increasing movement the vessel rate has been advanced from 32c. to 40c. from Toledo and Sandusky to Buffalo. Coal is not going forward to the upper ports any more freely. Last week shipments were 292,000 tons against 587,000 in the same week one year ago. For the season up to May 8 the docks loaded 1,095,523 tons against 1,850,000 tons in 1921.

Coal buying in this district is confined to steel mills and the railroads. Three large steel plants in Cleveland are getting substantial tonnages of West Virginia and Kentucky coal for coking purposes.

COLUMBUS

With the demand for all grades and more especially mine run and screenings growing stronger, prices are gradually advancing. Non-union coal is coming in large quantities and this takes care of the current demand.

Retail trade is slow as the summer has finally arrived. Retail prices have advanced in sympathy with the higher mine prices.

The larger part of the industrial demand comes from iron and steel plants. A considerable tonnage of Pocahontas mine run is now coming into Columbus territory and New River coals are also coming in large quantities.

Railroads are now coming into the market and some of the larger producers are trying to get in on railroad contracts. The Lake trade looks brighter than earlier in the season.

EASTERN OHIO

That a brisk buying movement in non-union coal is now under way is evidenced by the increased shipments that are reaching this section. The larger industrials and railroads are replenishing stocks, and a number of concerns, which had only a sixty-days' supply of fuel on hand at the beginning of the strike, are in the market, picking up coal here and there.

Cross-Lake shipments are being made to bolster up weak spots in coal reserves at industrial centers on the Lower Lakes, thus indicating that West Virginia and eastern Kentucky non-union coal shipped to lower docks originally intended as Lake cargo for the upper parts is moving over new and unaccustomed routes to buyers.

All non-union mines in eastern Ohio continue down and some of the wagon mines employing union labor, which were permitted to continue operations for the purpose of supplying public utilities, have been ordered closed because of alleged furnishing of coal to consumers other than public utilities. However, eastern Ohio stripping mines, with a potential capacity of 50,000 tons per week, continue to operate and are producing between 30,000 and 40,000 tons. Spot prices have stiffened slightly during the week.

Bituminous coal receipts at Cleveland during the week ended May 6 show a substantial increase over the preceding week and are now estimated at 75 per cent of normal requirements. Arrivals were the heaviest since April 1. Total cars received were 1,141. The quantity of coal now available in the open market, coupled with reserve stock on hand, has been ample to meet all demands, notwithstanding increased industrial activities.

DETROIT

Apparently the Detroit buyers continue to view the mine workers' strike complacently and without alarm concerning its possible effect on fuel supply. Business continues very light and it is difficult to interest customers to a buying point. With improvement extending in business and industrial lines, the seeming indifference of steam coal users is explained by the fact that many of them still have reserves of considerable proportions.

The domestic trade is flat, with retail dealers doing no buying and worrying lest a reduction in freight rates may place them in a position where they will have to take a loss on stocks on hand.

Pocahontas lump and egg is quoted $2.75@$3 at the mines, run of mine is $2.40@$2.50, nut, pea and slack, $2@$2.25. West Virginia lump is $3, run of mine, $2.50@$2.65, nut, pea and slack, $2.25. Eastern Kentucky run of mine is $3.

PITTSBURGH

The monthly report of the American Iron and Steel Institute indicates that production of steel ingots in April was at the rate of about 36,500,000 tons a year, against a rate of 32,500,000 tons in March, when even the March production was the highest since November, 1920. The steel mills have been active buyers of coal in various non-union districts, not merely for early deliveries but for extended periods. The latest transaction reported involves the purchase of 200,000 tons of Pocahontas by the Jones & Laughlin Steel Co. There has been free buying of Kentucky coal, while it is understood that a good sized tonnage of coke has been bought in Alabama for water shipment north to various blast furnaces.

Connellsville coal has advanced farther, on account of buying demand from the East, for New England and for a large steel interest at Baltimore. Connellsville steam coal is now $3.25@$3.50, fully 25c. advance in the week. Buying of Connellsville coal by local and valley steel interests has been lighter in the past three weeks than formerly.

There have been no production decreases in the past two or three weeks, and it seems altogether improbable that the striking will spread any more. The non-union strikers are staying out much better than was expected, considering that they have not had the practice in striking the regular members of the U.M.W. have had in the past quarter century.

BUFFALO

The state of the trade naturally favors some advance in prices. The advance is a dollar or so, which the mining districts began to ask very soon after the strike started.

The real strike test is of no pay on one side and no coal on the other, so it is going to be some time yet before anybody gives in. It is reported that non-union mining is increasing in some parts of the Allegheny Valley. Sales are apparently as light as ever. Consumers have considerable coal yet and are not alarmed. Business improves slowly. The iron furnaces are apparently most active, but they are getting their coal by Lake at a low figure and are out of the general market. Ten such cargoes arrived last week.

A fair quotation is $4 for Youghiogheny gas lump (next to none in market), $3@$3.50 for Pittsburgh and No. 8 steam lump and $2.50@$3 for all mine run and slack. To this add $2.36 to Allegheny Valley and $2.51 to other coals for freight.

NORTHERN PANHANDLE

All except two mines are in operation, the two mentioned being in Triadelphia District. In some sections trouble has been and is being experienced in preventing interference with the men who will work but upon the whole operations are satisfactory.

Cincinnati Gateway

Improvement in Buying Injects Vim Into Market

Smokeless Prices Up with Strong Call from Tidewater, Steel Mills and Railroads—Car Movement Unprecedented, but Demand Is Even Heavier.

STRONGER buying all around has made this market very lively. Smokeless coals have ascended as the Tidewater call is strong, steel mills are ordering heavily and railroad buying is on the increase. Tonnage is getting scarce and many shippers are booked up past June 1. Car movement from southeastern Kentucky is daily making new records, but demand is keeping about two leaps in advance of the heavier supply.

Pocahontas tonnage is the heaviest on record and is still gaining. New River is in better condition and more mines have resumed. High-volatiles are in strong demand at Tidewater and prices have been brought to the general range of $3@$3.25, which now prevails on all coals.

CINCINNATI

Demand is such that at the present time little thought is given to sizings, preparation or quality. There is in prospect a lot of haggling over shipments that will have to be threshed out at a different time, for there is no great care exercised to see that sales specifications are being carried out.

The strengthening Tidewater price of smokeless was reflected by an advance here, with a $3@$3.25 price range prevailing on all coals. The steel people too are coming in stronger and this has sent the price sky-high with more orders in the market than there is coal to fill them.

In the bituminous line there is a much scrambled situation. The lake buying, which was first to tilt the prices upward has not let down in the least. The higher the price, seemingly, the greater the interest and buying orders. Added to this is active buying on the part of another big railway system, which gives an outlet to the splints. Southeastern Kentucky is pouring coal through this funnel at a rate that creates a new record movement every day.

Retailers are talking of advancing the price of smokeless now that the wholesale price has advanced to $3.25 and their supplies are more uncertain. Some of them are making for the price $8 for lump and $7 for run of mine, an upward tilt of 50c. Bituminous lump is still quoted $6.50 and screenings at $5.

SOUTHEASTERN KENTUCKY

Demand is good and prices a little stronger. Production is averaging around 80 per cent of potential capacity. The loss is partly car shortage, some little labor trouble at union strongholds and labor shortage at mines that have been down for a long period and recently starting up.

Mine run is the go, very little prepared being made. Demand is now coming from a larger variety of users, while the first three or four weeks of the strike most of the coal went to steel plants and railroads.

LOW-VOLATILE FIELDS

New River and The Gulf

The tide appeared to be definitely turning in favor of the New River operators during the early days of May when a number of locals of miners, after holding a series of meetings, signified their willingness to return to work. The opinion is expressed that before the end of May, most of the mines will be in operation again. Market conditions are helpful in making a resumption of operations possible.

By the end of the first week of May, there was little to indicate that the strike had affected the Winding Gulf field in any way. Production was ranging above 25,000 tons a day. There was a somewhat better demand than had previously existed for Gulf coal.

Pocahontas and Tug River

Pocahontas production is on an unprecedented scale. With smokeless now more in demand mines are producing the heaviest tonnage in the history of the field. Although Western shipments are unusually heavy and orders from Cincinnati are on a large scale, yet the Eastern demand is reaching larger proportions.

Tug River mines are maintaining their output at 100,000 tons a week in the aggregate, with much of the coal so produced moving to Western markets. There is a brisk demand both for mine run and screenings among the steel manufacturers. There is no evidence of a strike in this region and miners are giving no thought to ceasing work. On the contrary they are bending their efforts toward increasing production.

HIGH-VOLATILE FIELDS

Kanawha

There has been a growing production since the beginning of the strike and between 30 and 35 mines are now producing coal. Miners are becoming restless and are manifesting a keener desire to return to work. With the betterment of demand prices are also advancing.

Logan and Thacker

Logan fields are all in operation and some of them are producing to capacity. The demand in steel centers is particularly strong, some coal going into the Pittsburgh District. Lake business is also growing. There is no industrial trouble in this region to mar production and earnings of miners are larger than they ever were.

Thacker production has now reached 145,000 tons a week and "no market" losses have been reduced to about 13 per cent of capacity. So far there has been no interference with operations because of the strike, although the union still claims the existence of a strike in this territory. Market conditions are propitious for a large production with the demand growing from day to day.

Northeastern Kentucky

The strike is not affecting this district except as to one or two mines producing domestic and steam coal. The principal demand is for byproduct gas coal and mines have all they can do to handle the growing volume of business. Lake shipments are also heavy. The Chesapeake & Ohio and the L. & N. are taxed to handle the heavy tonnage tendered them.

West

KANSAS CITY

The situation remains unchanged. So does the drowsy demand. If mines could reopen today it is doubtful if there would be enough call for coal to justify operating. Apparently there is more fuel in storage than was supposed. It will last at least another month. Expectation of lower freight rates keep some buyers out of the market. Dealers, having been so badly stung on spring stocking last year, that they cannot be induced to stock now. When the late summer arrives and demand picks up, they may be unable to meet the demand even at high prices.

DENVER

No change has been made in market prices since the wage reduction Nov. 1, 1921, by many of the large operators. Domestic coal is selling at $5 per ton for lump and $4.50 for nut. Mine run is quoted at $3.50, while slack varies from $1.50@$2 a ton.

SALT LAKE CITY

Utah production for April was 255,319 net tons, which is a decrease of about 30,000 tons under the production of the month before. The public, after its flurry of interest in the gun-play of 10 days ago at one or two points in the mining fields, now is apathetic again toward the whole strike situation. A drop in freight rates to the coast is expected to stimulate shipping to coal markets in that direction.

Canada

TORONTO

The market continues very quiet, and the coal situation excites but little interest, owing to the slackness in the demand. Retailers are generally stocked up sufficiently to meet all requirements on the present scale for many weeks to come, and have so far made no change in prices to correspond with the advance at the mines.

Quotations are as follows:

Anthracite egg, stove and nut	$15.50
Pea	14.00
Bituminous steam	9.25@9.75
Domestic lump	11.25
Cannel	16.00
Wholesale f.o.b. cars destination:	
¾ in. lump	$8.90@$9.00
Slack	7.25@7.75

News Items From Field and Trade

ALABAMA

The Birmingham Ice & Cold Storage Co., which has conducted an extensive retail coal business in Birmingham for over thirty years, has retired from this branch of its activities and disposed of its business to the **Ivy Leaf & Piper Coal Co.** The latter already operates a number of retail yards in the city.

ALASKA

The Department of the Interior is perfecting plans for the operation of two coal mines in the Chickaloon District, which have been under development by the Navy and which have been turned over to the Interior Department. It is hoped to lease the mines to some responsible engineering or coal mining company possessing the commercial experience and financial resources necessary to develop and operate with a primary object of supplying coal for Naval purposes. The detailed plans were discussed with a number of companies, and were definitely considered by four firms. Of these, the **Lake & Export Corporation**, of Huntington, W. Va., was the only one considering the prospects sufficiently godd to warrant the expense of a preliminary field and engineering examination. Accordingly, the department has agreed to give that company until July 15 to complete an examination of the mines and possible markets and to make an offer for leasing and operation.

COLORADO

Arrangements have been made for the transfer of **B. W. Dyer**, federal mine inspector for Alaska, to the position of district supervisor of the coal leasing work of the Bureau of Mines, with headquarters at Denver.

ILLINOIS

The question of purchasing power for coal mines versus generating power by the mines themselves in groups will be thoroughly discussed on the evening of May 22 in Chicago at a joint meeting of the Chicago section, American Institute of Electrical Engineers; the Chicago section, American Institute of Mining and Metallurgical Engineers and the Western Society of Engineers. Three papers will be read: "Central Station Power for Coal Mines," by J. C. Damon, engineer of the West Penn Power Co., Pittsburgh, Pa., "Purchased Power for Coal Mines," by J. Paul Clayton, vice-president of The Central Illinois Public Service Co., and "Purchased Power for Coal Mines," developing the idea of group generation, by W. C. Adams, of Allen & Garcia, Chicago. The meeting will be in the rooms of the Western Society of Engineers, 1735 Monadnock Building, Chicago.

The Union Fuel Co., with headquarters in Chicago and six mines at Springfield, has been reorganized. At a meeting of the board of directors **W. H. Leland** was elected vice-president and general manager in full charge of sales and operation. He is expected to lay down a new program of progress for the company and to build up a new organization to handle its business. Mr. Leland was once a vice-president of the Peabody Coal Co. and recently one of the vice-presidents of the Consumers Company of Chicago. Giving up his other connections, he will now devote his entire time to the Union. **L. J. Pulliam**, who was president and prime mover behind the old Union Fuel Co., is now chairman of the board of directors. The other officers chosen in the reorganization are **George F. Goodnow**, president, **Fred H. Baschen**, treasurer and **B. F. Bliss**, secretary.

W. A. Brewerton, of the Chicago office of the Sangamon Coal Co., was in Springfield recently.

F. A. Brazelton, general sales manager of the O'Gara Coal Co., Chicago, was a visitor recently at the company's offices in Harrisburg. He also visited mines in the vicinity of Harrisburg.

J. B. Burkhardt, superintendent of the Security Coal & Mining Co., at Duquoin, is enjoying a vacation of several weeks at Okawville.

The Illinois Coal & Coke Corporation has completely rebuilt the headframe at the Empire Mine No. 1 at Springfield and is repairing and remodeling the shaker screens at the same property.

The remaining machinery and property of the **Old Abe Mining Co.**, at Du Quoin, has been sold by the sheriff to Robert Eaton, of Sunfield, who was the highest bidder. The mine was operated by the **Kanawha Fuel Co.**, of Milwaukee, and A. S. Austin, who was superintendent of the plant, has returned to Milwaukee.

The North Mine, at Royalton, of the **Franklin Coal & Coke Co.**, is undergoing some extensive repairs and improvements during the shutdown. The main shaft of the mine is being enlarged. New cages will be installed and when the shaft is completed five-ton cars will be used underground instead of two-ton cars now used.

T. S. Cousins, president of the Majestic Oil, Gas & Refining Co., Du Quoin, has returned from a business trip into the oil fields of Oklahoma. He divides his time between the oil and coal business, being general superintendent for the Equitable Coal & Coke Co., operating at Herrin, Du Quoin and Johnston City.

INDIANA

Suit for $5,000 in wages was filed by eighty-six coal miners recently in the Vanderburgh probate court against the **Blair Coal Co.**, which concern is bankrupt. The company has not operated for several months and an Evansville attorney was named receiver some time ago.

Special Judge James A. Blackburn, of Mt. Vernon, in the Gibson Circuit Court, has sustained a defense motion to quash the indictment in the case of the State against the **Big Four Coal Co. and Edward J. Hatchett.** The defendants were charged with a misdemeanor in their alleged failure to ventilate properly the Liberty Mine at Francisco, Ind., Feb. 16, 1921, when four men were killed by an explosion. The court held the indictment was faulty. However, he ruled that the corporation was indictable for the offense charged and ordered the case resubmitted to the grand jury or the prosecuting attorney himself to file a new charge. Early this year an attempt was made by the state to convict Charles Wilder, superintendent at the mine of manslaughter in the same connection, but he was acquitted.

Charles Martindale, of Indianapolis, master in chancery of the Federal Court, has fixed July 3 as the last date on which claims can be filed with James A. Cooper, a Terre Haute attorney, receiver for the **Roland-Power Consolidated Collieries Co.** The company filed a petition in bankruptcy on April 22.

The Diamond Block Mining Co., Indianapolis, has been organized with a capital stock of $100,000. The directors are A. B. Rabe, William B. Paul and William H. Stephens.

KENTUCKY

Recent heavy rains on Martins and Catrons Creek branches of the L. & N., out of Harlan, have interrupted service to a large extent. About three miles out on Catrons Creek 200 ft. or more of main-line track was washed away, and two trestles were put out of commission. This cut out car service for several days to part of the mines on this branch, including; **Harlan Fuel Co., Bowling Mining Co., Mahan-Ellison Mining Co. and Perkins-Harlan Coal Co.**

Recent charter changes in Kentucky were as follows: **Elkhorn Block Coal Co.**, Ashland, increasing capital from $15,000 to $125,000; **Middle West Coal Co.**, Ashland, reducing capital from $100,000 to $10,000; **Consumers Coal Association**, Louisville, $10,000, J. A. Woolfolk, T. H. Hicks and W. H. Roose; **Harvey Jellico Coal Co.**, amended articles placing number of directors at five, and changing meeting place from Louisville to Pineville; amendment signed by Edward H. Jewett, Walter Brooks and L. H. Stone.

Special agents of insurance companies report that very little strike insurance has been written in Kentucky this spring for coal mines, the operators having refused to consider such insurance, even at low rates at which it was written.

The Cumberland Valley Coal Co., a corporation organized a few weeks ago by White L. Moss and associates, with headquarters at Pineville, will establish offices and maintain a selling agency either at Hazard or Whitesburg. This company will do business in the eastern Kentucky field.

Ordered abandoned a short time ago and then dismantling halted by telegraphic instructions, the town of Cherry, is awaiting definite word as to the plans of the St. Paul Coal Co. as to the Cherry Mine. The company recently announced that it had been found cheaper to purchase fuel than to continue operations in the northern Illinois field. This was accompanied by instructions to dismantle the workings at Cherry. Then residents of the town, realizing that the order meant doom for the town, sent a petition to the general office of the company setting forth the hardships which the abandonment order would work. Cherry is now awaiting the final decision of the St. Paul Coal Company with interest.

MISSOURI

The Central Coal & Coke Co., had a cave-in at the Fleming Mine, located on the Wabash and Santa Fe, at Camden. This mine was first opened in 1876 and has been in operation only spasmodically, account of the high cost and mining conditions.

In 1915 an economical method to operate the mine was hit upon and it was opened in 1917 and has continued to return a revenue from that time on. The coal seam at Camden is thin and the roof and bottom are bad.

Carl Hirdler, for over thirty years traffic manager and manager of the smithing coal department of the Sligo Iron Store Co. of St. Louis, severed his connections with that company on May 1 to act in a similar capacity with the Wallace Coal Co., of St. Louis.

NEW YORK

Many coal firms in New York City have changed their addresses since May 1. Among these are the following: **Johnstown Coal & Coke Co.**, from 80 Broad St. to 11 Broadway; **E. H. Russell, Inc.**, transportation, from 80 Broad St. to 11 Broadway; **The Interstate Coal & Dock Co.**, from 32 Broadway to 1 Broadway; **The Coale Corporation**, from 11 Stone St. to 1 Broadway; **Pilling & Co.**, from 71 Broadway to 2 Rector St.; **Cosgrove & Co.**, from 149 Broadway to 40 Rector St.; **The Lee Coal Co.**, from 2 West 45th St. to the Whitehall Bldg., 17 Battery Place.

S. P. Woodside has been appointed chairman of the Coal, Coke & Iron Ore Committee, Central Freight Association Territory, 143 Liberty St., succeeding **J. C. Venning**, resigned.

OHIO

Papers have been filed with the secretary of state decreasing the capital of the **Walter-Wallingford Coal Co.**, Cincinnati, from $100,000 to $20,000.

M. T. Roach, president of the Logan-Pocahontas Coal Co., with headquarters at Charleston, was a recent visitor in the Cincinnati market.

William Pritchard, vice-president of the Long Flame Coal Co., of Stowe, W. Va., spent the first few days of May in Cincinnati on business.

The Ivy Branch Coal Co. of Ivaton, W. Va., was represented in the Cincinnati market a few days ago by **John W. Moore.**

H. S. Gay, representing the Gay Coal & Coke Co., was a visitor a few days ago in Cincinnati.

PENNSYLVANIA

Among coal companies recently incorporated are: **G. J. Walsh Co., Inc.**, Philadelphia, mining, preparing, selling and dealing in coal and coke; capital, $35,000; treasurer, Robert W. Griffith. Incorporators: George J. Walsh, Robert W. Griffith and J. Watson Harper, Germantown, Philadelphia. **Rutland Fuel Co.**, Pittsburgh, mining coal and leasing, owning coal lands; capital, $20,000; treasurer, Teddy R. Wineman, Derry. Incorporators: David L. Gensbigler, Charles M. Kemp and Teddy R. Wineman, Derry. **Rose & McGregor Coal Co.**, Pittsburgh, leasing, buying, selling and dealing in coal lands and mining; capital, $100,000; treasurer, Roy Rose, Sewickley. Incorporators: Roy Rose, C. C. McGregor, Pittsburgh, and F. J. McGregor, Crafton.

The Central Coal Association, Altoona, has issued an interesting 15-page booklet, "The Coal Strike in Central Pennsylvania."

J. J. Gibson, manager of the supply sales department of the Westinghouse Electric & Manufacturing Co., becomes assistant to vice-president in the new plan of organization and the establishment of a merchandising sales department. **A. A. Brown** is appointed manager of syndicate operations; **J. S. Tritle,** manager of the St. Louis office becomes manager of the merchandising sales department; **T. J. Pace,** assistant manager of the supply department becomes manager of the supply sales department; **C. E. Allen,** manager of the central station division of the Chicago office, becomes manager of the St. Louis office; **George Baily,** assistant to the manager of the supply department, becomes supervisor of distributing agents; **M. C. Morrow,** assistant sales manager of the Westinghouse Electric Products Co., becomes assistant to the manager of the merchandising sales department, and **J. J. Dorney,** manager of the Industrial Division, St. Louis office, becomes assistant to the manager of the merchandising department.

All operating mines in the coke region have held their own or shown slight gains recently, except the Reliance Coke Co., at Denbo, near Brownsville. It is located on the Monongahela River between two union mines of the Vesta Coal Co., and was forced to suspend after making a start. The Mather Collieries Co., is nearly normal and Crucible Fuel Co. is running 70 per cent. The Crystal plant of the Hillman Coal & Coke Co., the only one of its coke region plants it has been able to keep going steadily, increased till it is now normal.

Edward L. Clemmer, of Brownsville, world war veteran, and until recently on the engineer corps of Alicia No. 1 and No. 2 coal and coke plants of the Pittsburgh Steel Co., has been appointed county engineer.

With the coal mines of Pennsylvania practically at a standstill, the number of **mine fatalities during April** decreased from 87 in March to 38, according to figures made public by Clifford B. Connelley, Commissioner of Labor and Industry. The total number of fatalities for April was 104, compared with 172 for March, in all industries. This is the lowest fatal record for any month this year.

As far as can be learned no clues have been found that would lead to the apprehension of incendiaries who recently destroyed the blacksmith shop at the Coalville Mine of the **Penfield Coal & Coke Co.,** Weedville, with a resultant loss of from $6,000 to $8,000.

Fire of unknown origin destroyed the **Spruks Coal Co.** breaker at Childs, near Carbondale. The breaker was recently purchased by the Spruks company, of Scranton from the Stone Coal Co. This morning's blaze means a loss of between $40,000 and $50,000.

The H. C. Frick Coke Co. is replacing the steam equipment at the Colonial No. 3 plant, at Grindstone, Fayette County, with electric equipment, power to be furnished by the West Penn Power Co., who is now running the line from the Brownsville, substation to that point. The Frick company will distribute the power to some of the other nearby plants, among them being the new big river plant it is putting in near Fayette City; where coal from several mines, which are connected together on the inside, will be assembled underground for river loading.

At the twenty-fifth annual meeting of the **American Society of Testing Materials,** to be held June 26-30 at Atlantic City, the Seventh Session, on June 29, will be devoted to coal, coke, timber and shipping containers. The report of committee D-5 will be heard on recommending revisions in standard methods of sampling coal and in the tentative method of testing for fusibility of coal ash. Hubb Bell will present a paper on forms of specifications for purchasing coal. E. B. Ricketts will outline governing factors in coal purchase and present a basis for comparing coals of differing ash contents.

TEXAS

Work has started on the construction of the coal bunkering plant of the **Channel Coal Co.,** near Houston. This will be the first ship bunkering plant to be built on the Houston Ship Channel, and is being built under a thirty-year franchise granted the Channel Coal Co. The first unit has an estimated cost of $48,000. Modern machinery and equipment for unloading coal from ships and barges will be installed.

VIRGINIA

The United States Circuit Court of Appeals at Richmond has reversed the judgment of the United States District Court at Charleston, W. Va., under the terms of which the **Fort Dearborn Coal & Export Co.** was allowed the sum of $16,318.24, representing 897 tons of mine run confiscated by the Norfolk & Western in August, 1920, for fuel purposes, at Bluefield, this coal being confiscated enroute to Lambert's Point for export. The appeal court holds that in ascertaining damages, the value of the credit the plaintiff would have received in the pool at Lambert's Point should have been made the determining factor, instead of the price of the coal at the mine. Inasmuch as the market was falling somewhat at the time, it is indicated by the records that the value of the coal in the pool would have been less than the purchase price. The coal was secured from the **Old Dominion Coal Corporation.** Following confiscation that company sued the Fort Dearborn company in the circuit court of Kanawha County and was awarded the amount of the sales price.

WEST VIRGINIA

C. H. Jenkins, of Fairmont, secretary and treasurer of the Hutchinson Coal Co., was a recent visitor in the Clarksburg district.

Clarence D. Robinson, one of the leading operators of the Fairmont region was called to Winchester, Va., not long ago, by the death of his brother, Charles Robinson, who had been ill during the greater part of the winter.

It has been possible for the **Penn-Mary Coal Co.,** which is a subsidiary of the Bethlehem Steel Corporation, to resume operations at several of its plants in Preston and Monongalia counties in northern West Virginia, five mines of the company now being in operation.

Two companies heretofore in idleness have resumed operations on the Charleston Division of the Baltimore & Ohio. They are the **Copen Creek Coal Co.,** operating at Copen and the **Braxton & Pittsburgh Coal Co.,** operating in the same vicinity. The mines of both companies have been shut down for some time.

Recently an explosion occurred in the Summerlee Mine of the **New River Co.,** at Summerlee. At the time of the explosion old timbers were being shot out near the shaft bottom, preparatory to retimbering, for which purpose permissible explosives were used. Shots were fired from the surface by means of a battery. It is believed that the explosion was caused by stirred up coal dust and an excess of explosives. The blast caused considerable damage in and about the hoisting and the air shafts, partially closing them.

An important event in the Wyoming County field at the end of April was the shipment of the first car of coal from the new plant of the **Raleigh-Wyoming Coal Co.,** at Glen Rogers. Two years have elapsed since the company, composed largely of Boston capitalists, started development work on a large tract in Wyoming County, under the direction of Carl Scholz and no effort has been spared to make this one of the most modern plants in the state. It is possible with the equipment and machinery installed to hoist coal at the rate of 6,000 tons every shift. The Beckley seam of coal is to be mined from shafts sunk to a depth of 600 ft. In order to make development of this coal possible the Virginian Ry. extended its line from Maben up Milam Branch of Guyan River for a distance of sixteen miles.

The American Coal Co., of Alleghany County, McComas, in the Pocahontas field, has contracted with Roberts & Schaefer Co. for the installation of a dry cleaning plant at its Crane Creek operation. Slack coal from this operation was given a thorough test at the plant of The American Coal Cleaning Co., at Welch, and the reduction of ash made by these tables so impressed the mining company that it determined to replace its washery with the dry plant. This installation is made in conjunction with the construction of a steel Marcus tipple.

H. H. Morris, former general superintendent of the Chesapeake & Ohio, is now located in Huntington, as resident manager for the Wholesale Coal Co., and the Bertha Coal Co., of Pittsburgh, Pa.

WISCONSIN

The 10-ton bridge now under construction at the dock of the **Superior Coal & Dock Co.,** Superior, will be ready for work early in July. This will materially add to the handling facilities of the dock.

Dock men of Duluth and Superior held a meeting recently at Superior, to discuss ways and means to reduce risk of loss by tornado. Twenty-four docks at the Head-of-the-Lakes were represented at the conference.

The Fellenz Coal & Dock Co., which operates a dock yard near Racine St., Milwaukee, will soon displace its present figure-4 derrick hoist with an electrically operated steel bridge hoist, which will unload coal from vessels at the rate of 500 tons per hour. Other improvements, including railway tracks and increased storage room are being made. The Fellenz dock is one of the oldest retail coal yards in Milwaukee.

BRITISH COLUMBIA

OUTPUT FOR MARCH, 1922

Mine	Tons
Vancouver Island District	
Western Fuel Corporation of Canada, Nanaimo	64,890
Canadian Collieries (D) Ltd.	
Comox	24,108
Extension	20,206
South Wellington	8,610
Granby Cons. M. S. & P. Co.	26,787
Nanoose Wellington Collieries	8,750
Old Wellington (King & Foster)	513
Total	153,864
Nicola-Princeton District	
Middlesboro Collieries	5,473
Fleming Coal Co.	3,109
Coalmont Collieries	11,671
Princeton Coal & Land Co.	2,003
Total	22,256
Crow's Nest Pass District	
Crow's Nest Pass Coal Co.	
Coal Creek	56,780
Michel	33,240
Corbin Coal & Coke Co., Corbin	7,430
Total	97,450
Grand Total	273,570

QUEBEC

Soft coal is being imported into Montreal by sea from the Virginia and Pennsylvania coal fields cheaper than it can be brought from Sydney, N. S. All large consumers are stocked sufficiently to provide for their requirements for several months. Since the opening of navigation two steamers have arrived laden with coal from Norfolk, Va., and three others are on the way. The coal was shipped since the strike and is from non-union mines. **The Dominion Coal Co.,** although it usually has its yards empty by May 1, has on hand 54,000 tons of coal, carried over from the winter.

WASHINGTON, D. C.

Godfrey M. S. Talt announces the removal of his office to 808 Eighteenth St., N. W., where he will continue the preparation of coal property valuations as a guide to investors, banking houses, and for obtaining tax adjustments.

G. R. Mansfield has been placed in charge of the section of the Geological Survey devoted to non-metalliferous deposits.

W. T. Lee is continuing a study for the U. S. Geological Survey of the stratigraphy of the oil sands in southern Wyoming.

Charles Butts is investigating the stratigraphy and the paleontology of the lower paleozoic formations in Georgia, Alabama and Tennessee.

J. D. Sears, James Gilluly and W. H. Bradley will do geological work in Moffat County, Colorado, during the coming field season.

A. E. Fath and W. W. Brubey are to make a study of oil prospects in that part of eastern Wyoming which borders on the Black Hills.

D. F. Hewett is looking into reported discoveries of oil near Fallon, Nevada. While in the state he will make a study of the application of aluminum salts to certain soils.

A. F. Melcher will make a study of the porosity of oil sands in the Burbank field of Oklahoma, for the U. S. Geological Survey.

As a result of the discovery of oil, near Avon, Mont., the U. S. Geological Survey has sent **A. J. Collier** to the region to study its geology.

C. E. Dobbin, A. H. Redfield and J. E. Hoffmeister have been assigned to work on the coal fields of Garfield County, Mont., for the U. S. Geological Survey.

A study of the pleistocene and tertiary deposits of the Columbia plateau of eastern Washington and the neighboring parts of Idaho is to be made during this field season by **J. T. Pardee**, of the U. S. Geological Survey.

An examination of the Wasatch plateau coal fields is to made by **E. M. Spieker and J. B. Eby** of the U. S. Geological Survey.

Traffic News

In the complaint of the **Clay County Coal Operators' Association**, an I. C. C. examiner recommends that rates on coal from points on the Horse Creek branch of the Cumberland & Manchester R.R. to interstate destinations are unreasonable because they exceed by more than 10c. the rates to the same destinations from points on the main line of the road.

In the complaint of the **Northwestern Traffic and Service Bureau** an examiner recommends that rates on hard coal from Milwaukee, originally consigned to Vesta, Minn., diverted in transit at Sanburn, Minn., and reconsigned to Darfur, Minn., were not unreasonable.

Edward E. Marshall, of Philadelphia, has complained against unreasonable rates on coke from Elkhorn, W. Va., to Harrisburg, Pa.

The I. C. C. has suspended until August 13 the proposed cancellation of joint through rates on bituminous and cannel coal from the Bessemer & Lake Erie R. R. Group No. 1 points, located in Pennsylvania, to various destinations on the Buffalo, Rochester & Pittsburgh, located in New York and Pennsylvania.

The C. Reiss Coal Co., of Cheboygan, Wis., in a complaint to the commission alleges unreasonable rates on coal from Pittston, Avoca and Dunmore, Pa., to St. Paul and Minneapolis.

The Megeath Coal Co., of Omaha, alleges unreasonable rates on coal from Winton, Wyo., to points in California, Nevada, Utah, Oregon, Idaho and Montana.

The commission has assigned for hearing at Washington, May 22, the matter of divisions of joint rates on coal between the **Ohio & Kentucky Ry., and the Louisville & Nashville.**

In the complaint of the **M. E. Case Coal Co.** an I. C. C. examiner recommends that the commission is without jurisdiction to consider intrastate rates on coal from La Marsh, Ill., to Galesburg, Ill., moving subsequent to the termination of Federal control, on the state of facts presented.

The Public Utilities Commission of Idaho has complained against unreasonable commodity rates from and to points on the Boise Valley Traction Co. lines by reason of failure to establish joint through rates. The commission asks for joint rates on coal and other products.

In the complaint of the **Loogootee Fire Clay Products Co.**, the commission decides that the rates on bituminous coal from Wheatland to Vincennes Ind., and from Montgomery and Cannellburg to Loogootee, Ind., during Federal control were unreasonable.

In the complaint of the **Burns & Hancock Fire Brick & Clay Co.**, the commission decides that the rates on mine run bituminous coal from certain mines in the Clinton and Brazil districts in Indiana to the company's plants at West Montezuma, Brazil and near Terre Haute, Ind., during Federal Control were unreasonable.

In the complaint of the **Crookston Gas Co.**, an I. C. C. examiner recommends that shipments of coke from St. Paul to points in Minnesota from June 25, 1918, to the end of Federal control were overcharged and that the company is entitled to reparation. Complaint covering shipments from March 1, to Sept. 1, 1920, are recommended to be dismissed for want of jurisdiction.

Rehearing of the complaint of the **Roundup Coal Mining Co.** has been requested by the Northwestern Coal Dock Operators' Association, which asks the commission to fix rates on coal from Roundup, Mont., to points in South Dakota upon a basis higher than the scale adopted in the Holmes & Hallowell case, making allowance for adverse transportation conditions prevailing from Roundup to South Dakota points as compared with favorable conditions from Duluth to the same destinations. It is said the rates from Roundup are so low that they constitute an undue prejudice.

Recent Patents

Miner's Blasting Battery. Joseph S. Beeneck, Nanticoke, Pa., 1,408,435. March 7, 1922. Filed July 10, 1919; serial No. 309,948.

Device for Crushing Coal and Other Materials. Charles A. Kloman, Bellevue, Pa., 1,408,607. March 7, 1922. Filed June 25, 1919; serial No. 306,612.

Coal Distillation Retort. Arthur Roberts, Evanston, Ill., assignor to American Coke & Chemical Co., Chicago, Ill., 1,408,640. March 7, 1922. Filed Sept. 15, 1916; serial No. 120,351. Renewed Feb. 13, 1920; serial No. 358,432.

Coal Ladder. W. H. Towne, Otto M. Thjimoe and W. B. Mercer, Chicago, Ill., 1,408,659. March 7, 1922. Filed Dec. 3, 1920; serial No. 428,081.

Undercutting Machine. Frank L. O. Wadsworth, Sewickley, Pa., assignor to the Jeffrey Mfg. Co., Columbus, Ohio, 1,408,662. March 7, 1922. Filed April 13, 1912; serial No. 690,486. Renewed Nov. 24, 1919; serial No. 340,239.

Mine Car. Daniel C. Mulvihill, Hannibal, Mo., 1,408,767. March 7, 1922. Filed Dec. 20, 1920; serial No. 432,083.

Mine-Car Bearing and Axle. James C. Gaskill, Fairmont, W. Va., 1,408,878. March 7, 1922. Filed Dec. 15, 1921; serial No. 522,566.

Method of Mining Coal. Richard Battey, Black Diamond, Wash., 1,408,971. March 7, 1922. Filed Aug. 30, 1920; serial No. 406,821.

Gathering-Reel Mounting for Mine Locomotives. William E. Wolfe, Wilder. Va., assignor to the Clinchfield Coal Corp., Dante, Va., 1,409,328. March 14, 1922. Filed March 18, 1920; serial No. 366,936.

Mining Machine. George F. Dillig, Pittsburgh, Pa., 1,409,532. March 14, 1922. Filed June 9, 1920; serial No. 387,540.

Fastener for Mine-Car Doors. John Wysock, Plymouth, Pa., assignor of one-third to Anthony Visotski, Wilkes-Barre, 1,409,635. March 14, 1922. Filed May 20, 1920; serial No. 382,847.

Coal Agitator for Mechanical Stokers. Robert S. Riley, Worcester, Mass., assignor to Sanford Riley Stoker Co., Ltd., Worcester, 1,409,972. March 21, 1922. Filed April 13, 1917; serial No. 161,862.

Self-Dumping Mine Cage. William B. Reynolds, Roundup, Mont., 1,410,124. March 21, 1922. Filed Oct. 9, 1920; serial No. 415,757.

Means for Feeding and Mixing Powdered Coal and Air. Wm. R. Field, Decatur, Ill., 1,410,246. March 21, 1922. Filed March 15, 1920; serial No. 366,101.

Coke-Oven Smoke-Flue Carriage. Joseph Becker, Pittsburgh, assignor to The Koppers Co., Pittsburgh, 1,410,447. March 21, 1922. Filed Dec. 2, 1918; serial No. 264,967.

Automatic Door for Mines. John T. Thomas, Fort Myers, Fla., 1,410,425. March 21, 1922. Filed March 28, 1921; serial No. 456,144.

Mining Locomotive. Thomas E. Pray, Chicago, assignor to Goodman Mfg. Co., Chicago, 1,410,596. March 28, 1922. Filed July 19, 1919; serial No. 311,941.

Coking Retort Oven. Joseph Van Ackeren. Pittsburgh, assignor to The Koppers Co., Pittsburgh, 1,410,784. March 28, 1922. Filed April 27, 1920; serial No. 377,024.

Trade Literature

Grindle Powdered Fuel Equipment. Grindle Fuel Equipment Co., Harvey, Ill. Pp. 40; 8½ x 11 in.; illustrated. The advantages and savings, both in cost and labor, obtained by the installation of the Grindle system are interestingly told, as are also its operation and some of the uses to which it can be adapted.

Jeffrey 35-B Shortwall Mining Machine. The Jeffrey Mfg. Co., Columbus, Ohio. Bulletin No. 365. Pp. 11; 7½ x 10½ in.; illustrated. Describes the work performed by the 35-B Shortwall Coal Cutter in coal mines and mentions as one of its features the self-propelling Handitruck.—Advertiser.

Circuit Breakers. The Cutter Co., Philadelphia, Pa. Pp. 16; 6 x 9 in.; illustrated. A variety of remote-control circuit breakers, of both motor and magnetically operated types, together with other forms of apparatus especially adapted to central-station requirements are herein described.—Advertiser.

Type CSU Multi-Stage Automatically Balanced Centrifugal Pumps. Dayton-Dowd Co., Quincy, Ill. Bulletin 248. Pp. 20; 7½ x 10½ in.; illustrated.

Page-Armco Welding Rods and Electrodes. Page Steel & Wire Co., Bridgeport, Conn. Catalog No. 500. Pp. 40; 6 x 9 in.; illustrated. Describes the peculiar characteristics of Armco iron and shows its availability for various welding purposes. It gives the American Welding Society specifications for electrodes and some useful informaton for electricians.

Publications Received

Preparation and Uses of Tar and its Simple Crude Derivatives, by W. W. Odell, Bureau of Mines. Technical Paper 268. Prepared under a co-operative agreement with the Illinois State Geological Survey and the Department of Mining Engineering of the University of Illinois. Pp. 84; 6 x 9 in.; illustrated.

Ninth Annual Report of the State Inspector of Coal Mines of Colorado. Pp. 63; 6 x 9 in.; tables.

The Mineral Resources of the Pillippine Islands for the Years 1919 and 1920. Division of Science, Bureau of Mines, Manila, P. I. Pp. 70; 7½ x 10½ in.; plates and tables.

Evaporation Loss of Petroleum in the Mid-Continent Field, by J. H. Wiggins. Bureau of Mines. Bulletin 200. Pp. 115; 6 x 9 in.; illustrated, charts and tables. Report of investigations by the Bureau of Mines of the loss of gasoline by evaporation in the storage and handling of petroleum.

Mac's Directory of Coal Sales Companies. Coal Information Bureau, Pittsburgh, Pa. Pp. 160; 9 x 12 in. Price, $5. This book is made up in three sections. The first is devoted to list of coal companies, arranged according to states, with classification as to whether sales agent, operator or wholesaler; the second section gives the list alphabetically arranged and the third section contains a complete alphabetical list of sales officers, with company affiliation and city in which located.

Coming Meetings

National Retail Coal Merchants' Association. Fifth annual convention at the Drake Hotel, Chicago, Ill., May 18-20. Executive secretary, Joseph E. O'Toole, South Penn Square, Philadelphia, Pa.

Colorado and New Mexico Coal Operators' Association. Annual meeting June 21 at Denver, Col. Secretary, F. O. Sandstrom, Boston Building, Denver, Col.

National Coal Association will hold its annual meeting at Congress Hotel, Chicago, May 24 to 25. Committee on arrangements, Harry N. Taylor, chairman, Dr. F. C. Honnold and Walter Cunningham

The American Wholesale Coal Association will hold its annual convention at Detroit, June 1 and 2. Secretary, G. H. Merryweather, Union Fuel Bldg., Chicago.

The fourteenth annual meeting of the **International Railway Fuel Association** will be held in the Auditorium Hotel, Chicago, Ill., May 22 to 25.

American Society for Testing Materials will hold its twenty-fifth annual meeting June 26 to July 1, 1922, at Atlantic City, N. J., with headquarters at the Chalfonte-Haddon Hall Hotel. Assistant treasurer, J. K. Rittenhouse, Engineers' Club Bldg., Philadelphia, Pa.

The twenty-seventh annual convention of the **Illinois and Wisconsin Retail Coal Dealers' Association** will be held at the Hotel Highland, Delavan Lake, Delavan, Wis., June 13, 14, 15. Secretary I. L. Runyan, Chicago, Ill.

The annual convention of the **Pennsylvania Retail Coal Merchants' Association** will be held at Trenton, N. J., June 7 and 8.

American Institute of Chemical Engineers will hold its summer meeting at Niagara Falls, Can., June 19-22, with headquarters at the Clifton Hotel. Secretary, Dr. J. C. Olsen, Polytechnic Institute, Brooklyn, N. Y.

Southwestern Interstate Coal Operators Association will meet June 13 at 519 Keith & Perry Bldg., Kansas City, Mo. Secretary, W. L. A. Johnson, Kansas City, Mo.